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assembly & fastener ENGINEERING

How Hotpoint Paces Assembly

Also in this issue:

AiResearch Assembles Precision Parts in Pressurized Room

New Code for Hardware Grouping at Allis-Chalmers

Considerations for Torque in Product Design

JANUARY • 1960

and here's how Pheoll solved it

He's just a voice in the grandstand now — but as an official of a shoe company he himself recently quarterbacked a major victory. Faced with a fastener problem he called the signals that brought in the Pheoll team.

Briefly, the problem was one of redesigning a nut used in holding a stud to a football shoe cleat. In its original "straight notch" design, the stud often worked loose under game conditions.

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Enlargement of One Way Nut

HEADING THE FASTENER INDUSTRY FOR OVER 50 YEARS

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January, 1960 Volume 3, Number 1

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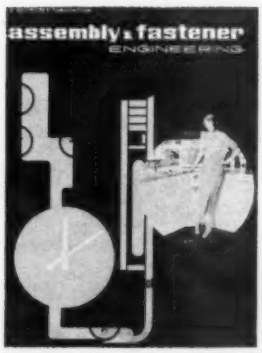
• The pace of the dishwasher assembly line at Hotpoint's Milwaukee plant is regulated by the conveyor speed to deliver the scheduled output, whatever it may be. For details, turn to page 26.



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Letters to the Editor

"Go Kart" Is Trade Name

Our company . . . being karting enthusiasts . . . appreciates the recent interest shown by your publication in this new field of activity.

Your most recent article indicated, however, that you perhaps are still unfamiliar with the correct terminology or designation . . . The recognized name for most vehicles of this nature is the word "K a r t." The recognized name for the sport is the word "karting."

The words "Go-Kart" are a part of the trade name and is the registered trademark of Go-Kart Manufacturing Co., Inc.

Frank S. Livingstone
President
Go Kart Mfg. Co., Inc.
Azusa, California

Managerial Rigor Mortis

Please advise if reprints of your November editorial, "Beware of Managerial Rigor Mortis," are available. We would like to use this article to stimulate participation in a personnel development program we have planned.

Ralph E. Kempe
Industrial Engineer
Square D Company
Milwaukee, Wisconsin

Christmas Message

Your cover editorial, "Still no substitute for His star," was truly enlightening.

In this hustle, bustle life of ours, and especially this time of the year when our thoughts are too far from the true meaning of Christ, it is r e f r e s h i n g that, through such a m e s s a g e, we should clear our mind of material things and imbue it with the true meaning of Christmas.

Harold G. Fiedler
Parts Standards Representative
Engineering Admin. Section
Tractor & Implement Division
Ford Motor Company
Birmingham, Michigan

The outstanding cover design of your December issue is timely and appropriate. You are to be commended for not losing sight of the opportunity to truly commemorate the Christmas season.

Gail M. Rutledge
Sales Manager
Thompson-Bremer & Company
Chicago, Illinois

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to reduce your inventories...

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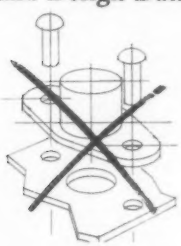

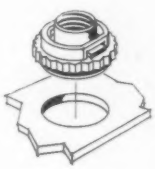

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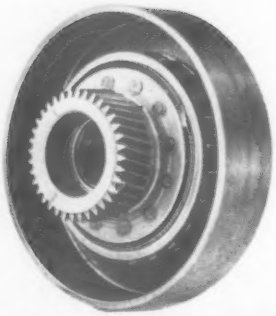

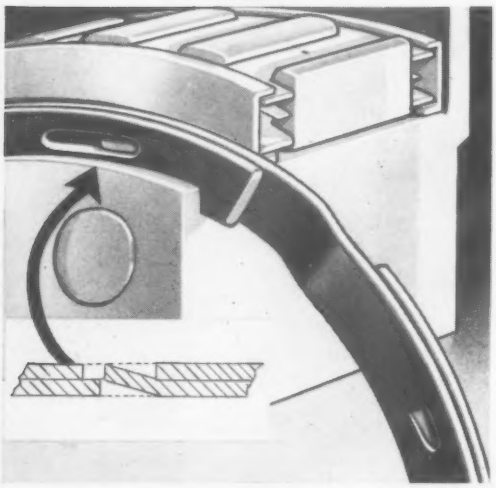

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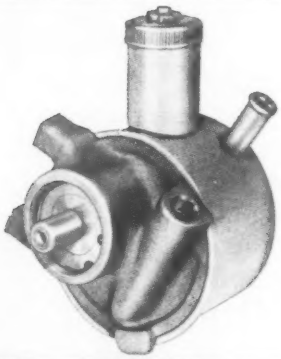
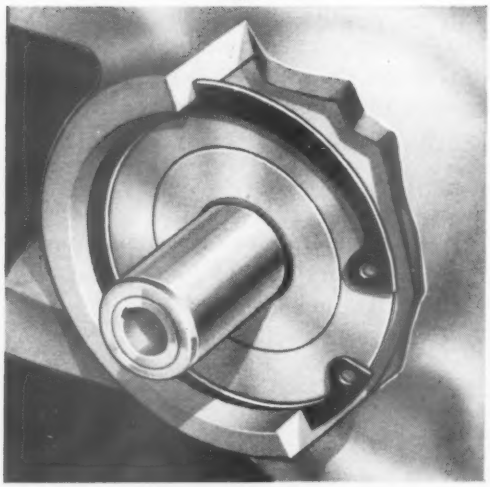
the Superior Solution for this GEAR ASSEMBLY used in a leading tractor

This exclusive 360° retaining ring in the patented SELF LOCKING TYPE provided the just right answer because it had all these important advantages: (1) full bearing surface; (2) ability to withstand stress; (3) positive prevention of unseating due to dirt or centrifugal force.





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the Superior Solution for this Power Steering Pump used in a leading make automobile

Circolox provided an improved answer to this retaining ring problem by meeting the need for low cost while at the same time improving on ring quality. Due to advanced manufacturing methods, these rings are furnished with an improved finish, smoother edges, uniform thickness, permanent set.

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The complete story of the tOtal 2 is now brought to you in the new Circolox Spirolox Catalog and Technical Bulletin Service. This catalog brings you all the facts about Ramco's tOtal 2 advantages. These include the tOtal engineering facilities of the world's most modern retaining ring plant and a price structure that assures fair, low prices free from extreme fluctuations. Your copy will be sent without cost or obligation. Fill in the coupon below and mail today!

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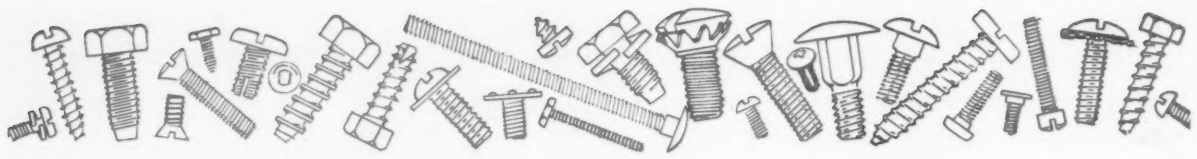

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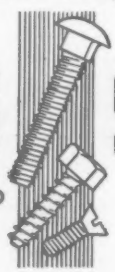

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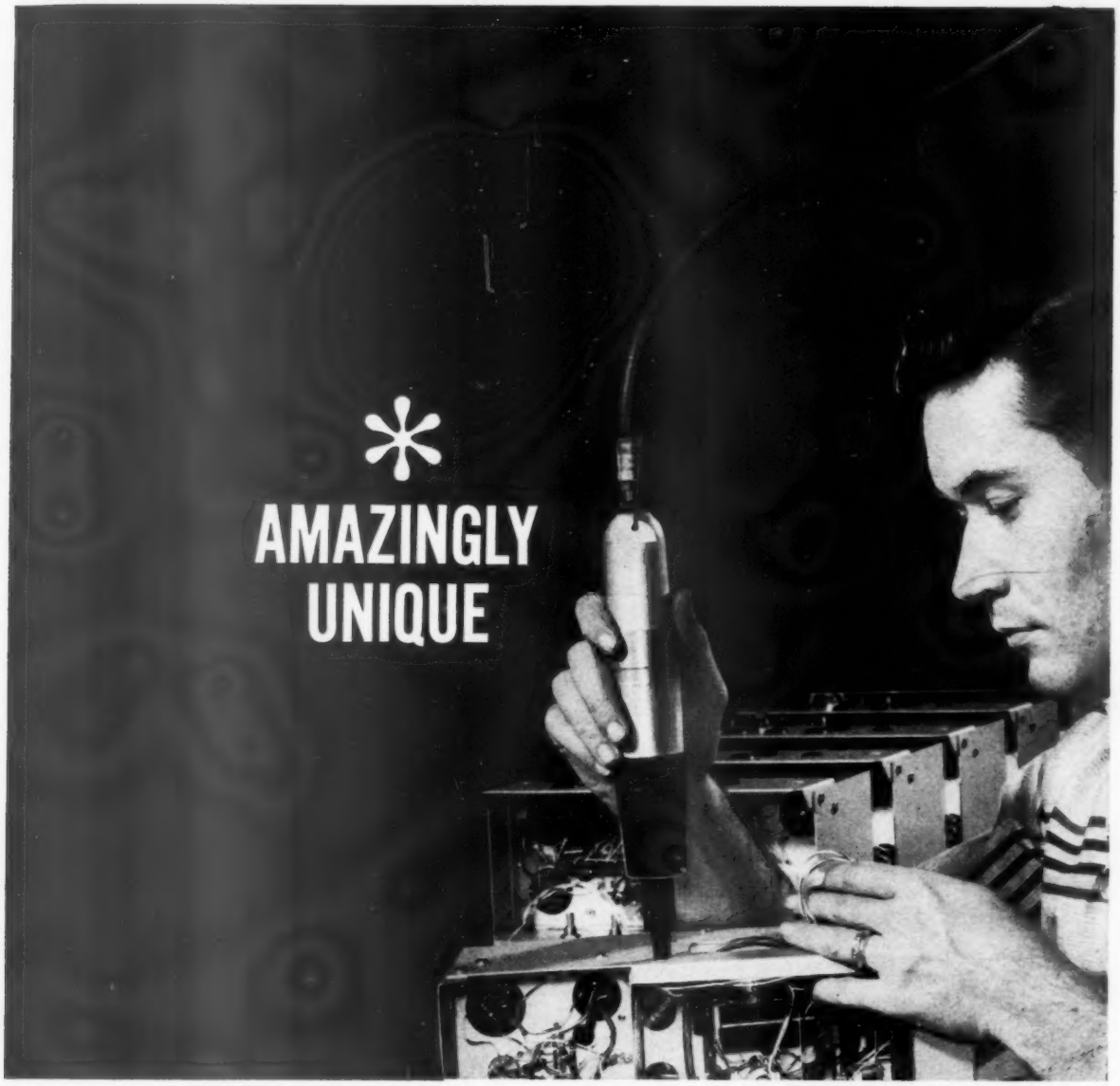

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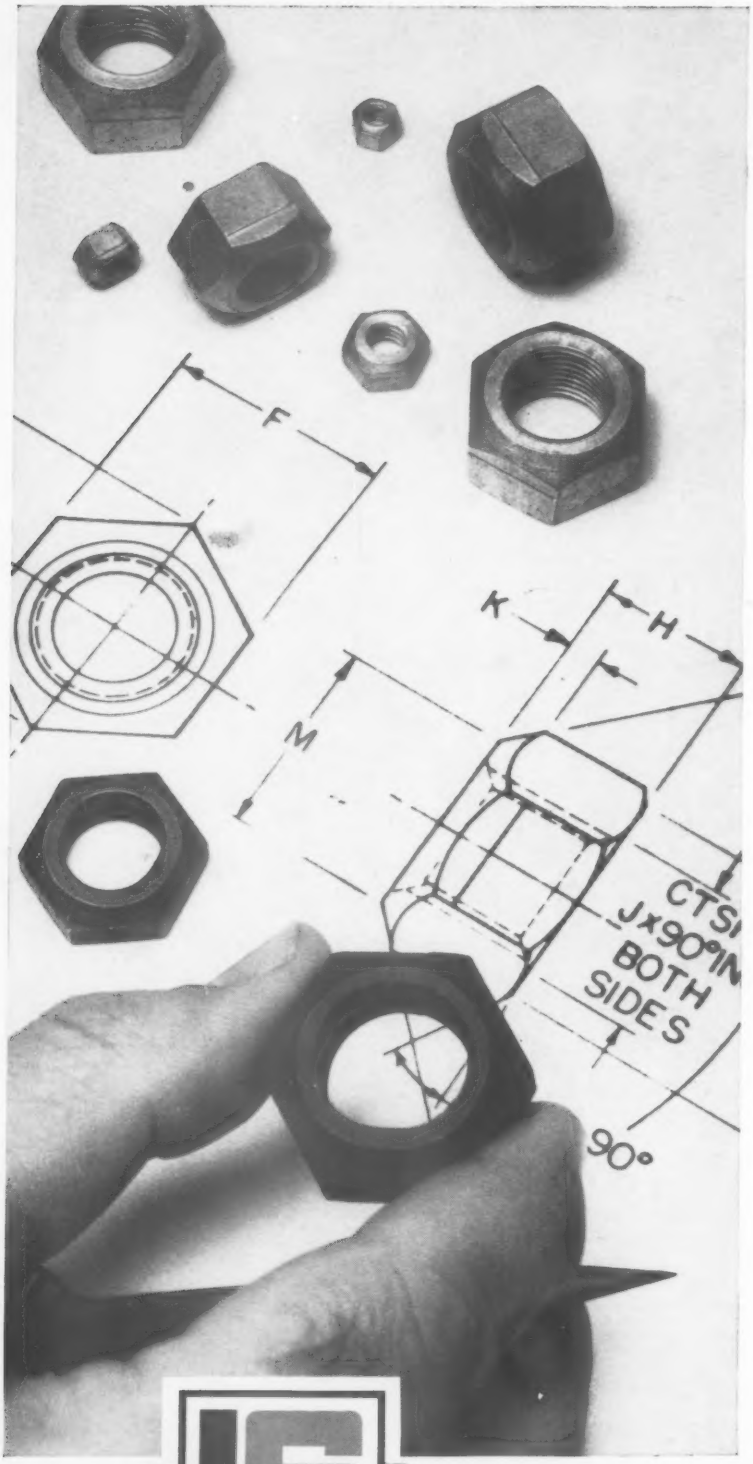

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draw up 33% tighter to increase squeak-rattle resistance

Car and tractor makers alone used about 80 million new-style Stover Lock Nuts in 1959. Reasons: savings in assembly, savings via improved squeak-rattle resistance in suspensions, steering linkage, chassis, engines, bodies.

You save in assembly: The new Stover needs only about ¾ the tightening torque to produce the same clamping force in bolts as produced by comparable standard fasteners and competitive lock nuts. Many companies are cashing in on this lower torque requirement by using air stall drivers, both single and multi-spindle. They're handy to use, stingy on air, economical to buy and maintain.

You save after the sale: Using your present drivers and air pressures, the new Stover Lock Nuts will draw up 33% tighter than comparable standard fasteners and competitive lock nuts—a whopping extra margin in squeak-rattle resistance and safe operation. Benefits: lower service costs, happier customers, repeat sales.

What's available: From ¼" dia. to 1½" dia. in fine and coarse thread. Grade A is for use on bolt and stud grades SAE 2 and lower; Grade B for use on SAE grades 3, 4 and 5 bolts and studs; Grade C for use with SAE grades 6, 7 and 8 bolts and studs. Stover nuts for use with machine screws No. 8 and larger are available on special order as are stainless steel and non-ferrous. Where space is a problem, such as on pinion and pulley shafts, Stover jam (thin) collar-type nuts in grades A and C are recommended.

For engineering information, price data and samples, contact Lamson & Sessions.

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JANUARY, 1960, VOL. 3, NO. 1

SOME OBSERVATIONS ON FOREIGN COMPETITION

Recently we had the opportunity to talk with a number of readers and advertisers from coast to coast. Invariably, the matter of imports came up relating to radios, cars, fasteners, and steel. Observations were made on what can and cannot be done.

First, what cannot be done. Government officials cannot favor much higher tariffs for fear we'll lose face as the great leader and benefactor of all nations. Business men cannot favor too drastic legislation for fear of more retaliatory tariffs. Even labor leaders cannot complain too vigorously for fear of losing ground in their overseas organizational work. So the prospect for legislation is almost nil.

In the face of growing imports, we already have those companies which have given up trying to lick the competition; they've joined them. Some are building production facilities overseas to supply their American markets; others are simply buying overseas and reselling under their own brand name. Besides taking the easy way out, these companies are evading their responsibilities to the very economy which supports them.

But for those companies desirous of meeting the challenge, there is an answer, but that answer must come from within their own organization.

Consider the case of the transistor radio business. It was going the way of the Dodo bird, until Zenith (and since then others) came up with a radio competitive with the best imported models.

Again, the typewriter business almost slipped away. A counter-offensive has been launched by Royal McBee with the opening of a new plant in Missouri. Equipped with the latest production tools, this plant will not be working under the handicap of obsolete equipment—the bane of many old-line companies.

This is a cue that too few American companies have taken from Germany's postwar recovery. They had no obsolescence problem. Our bombers did such an efficient job of destruction that they just couldn't rebuild without almost entirely new equipment.

But walk into many of our plants today, and you will see much equipment which should be scrapped. Sure, it still works and was amortized a decade or two ago. But the mere presence of out-dated equipment tends to retard the introduction of new manufacturing concepts.

On the other hand, it would be most difficult for a company with only the latest equipment to have anything but a forward-looking manufacturing philosophy.

In closing we will pass on the comment of a fastener manufacturer who is philosophical enough to admit that "foreign competition certainly keeps us on our toes. It also serves to make other countries more self-sustaining so that we won't have to give them so much aid."

Matt E. Hendrickson

Managing Editor

Captive Quick-Opening Fasteners:

Southco standards provide many benefits at low cost for access through doors, covers, panels and into drawers

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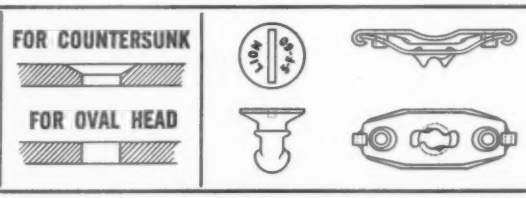

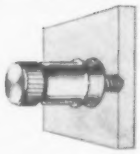

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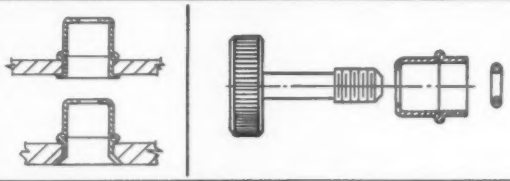
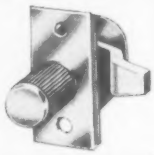
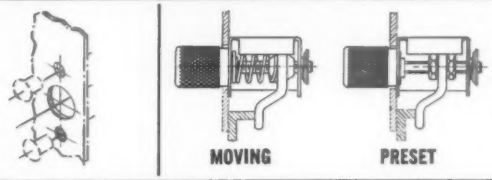
Stand-off thumb screws from stock to eliminate costly, special fasteners. Installed quickly without special tools. Accommodate misalignment. Complete range of standard sizes.

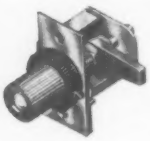




ADJUSTABLE PAWL FASTENERS

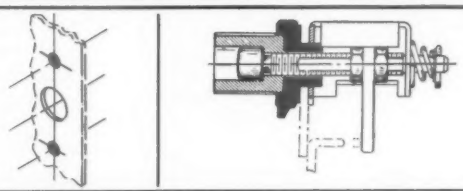
Pre-assembled, quickly installed. Accommodate variations in frame thickness up to ½ inch. One-quarter turn closes, additional turns increase grip pressure. Attractive appearance, long life. Moving or pre-set pawl. Miniature, intermediate and large sizes.





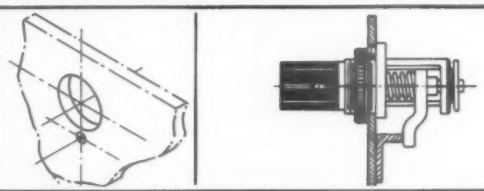
ADJUSTABLE PAWL FASTENER

Has twin-knob control. One knob controls pawl, pointer shows pawl position. Other knob controls amount of pressure to seal closure with uniform pre-set compression. Easily installed.



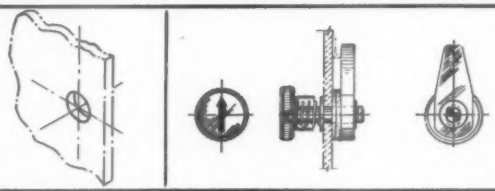
ADJUSTABLE PAWL FASTENER

Compact and rugged. Eliminates rivets or bolts to save installation time. Three types cover grip range up to ¾". Supplied either with integral metal and plastic knob, plastic knob or for your knob.



ARROWHEAD DOOR LATCH

Requires only one hole to install. Operates on quarter turn. Holds under spring tension. Arrow shows pawl position; no pawl stops required. Uses minimum inside space.



Free Fastener Handbook

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SOUTHCO FASTENERS
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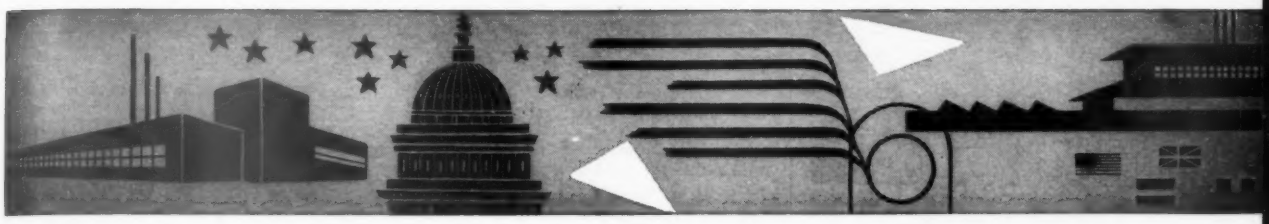
The State of Business



STEEL HOLDS THE KEY TO 1960

by **Dr. Emerson P. Schmidt**

This will be a prosperous year, we say with one eye cocked on the steel negotiations.

Assuming early union-management settlement, economic expansion will be more rapid in the first six months of 1960 than in the last half. Earnings, employment and output will rise to all-time highs, even though no sectors of the economy, other than inventory rebuilding, will be outstandingly strong.

There will be trouble spots. Housing starts will be down. Total construction may not exceed this year's level. Income of farmers will be lower. Consumer credit gains will be slower.

Beware of a false buoyancy in the first six months as inventories rebuild. By October 1960, the expansion which started in April 1958 will have run 30 months. This has been the average length of expansionist periods in some 25 business cycles in the last 105 years. Statistically speaking, another recession could start next October. The recent steel strike, however, is likely to postpone the date of the next downturn until some time in 1961, when normal inventory replacement patterns resume.

Well, let's move on to a political football—agriculture. Food prices will drop, and so will farm net income. Higher production costs will cause this, even though physical volume and dollar value of output will remain close to 1959 levels. "Political statisticians" will make hay with the fact that the expected $10.2 billion farm income will be the lowest since 1942. Few will mention, however, that there were 6.2 million farms in 1942, only 4.6 million now, with dollar income actually up 52% over 1942. And also, farmers' non-farm income is rising.

Price supports and storage costs rose from $7 billion to $8.6 billion in 1959 and will approach $10 billion by year's end.

Most analysts believe total new construction in 1960 will just about equal last year's $55 billion, which was up over $49.1 billion in 1958. Housing starts will decline from 1.3 million by 5 to 10% —still a good rate.

The F. W. Dodge Corporation anticipates a 1% decline in the dollar volume of construction contracts, and a 4% decline in physical volume.

Current steel shortages will also help postpone any downturn due to deferral of buying. Not only will some end products be in short supply early in 1960 but also quality deterioration will be evident.

". . . for want of a nail, the shoe was lost;
For want of a shoe the horse was lost;
And for want of a horse the rider was lost . . ."
Prefixed to Poor Richard's Almanac (1758)

EMERSON P. SCHMIDT
Director of Economic Research
U.S. Chamber of Commerce

One of the nation's leading forecasters has been with the Chamber of Commerce since 1943. Often called upon by Congressional committees to analyze business, Dr. Schmidt is an author, teacher, advisor.

David McDonald may go down in history as the most expensive labor union official in our experience. The price-tag for the recession caused by the steel strike may run as high as $8 billion, with only a part of the losses to be made up.

Capital spending prospects look bright. One survey indicates that business plans to spend $37.3 billion for plant and equipment, a 10% improvement over 1959, all but about $6 billion to be internally financed. (The record of $38.4 billion was set in 1957.)

Manufacturing expenditures should rise from about $10 billion in 1959 to $12 billion.

While most major categories are pointing up, new spending for food manufacturing, miscellaneous manufacturing, petroleum and mining are down.

continued

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EYE BOLTS

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• *Fast Shipment*

Now! Allmetal carries, **in stock,** quantities of rod end "blanks" ready for instant threading and drilling. Get mass production economy, highest quality, prompt delivery. Stock diameters 1/4" through 1/2" in varied lengths.

*Head diameter of rod end is nominally two times the diameter of the shank. When requesting quotation, please indicate hole size and thread length.

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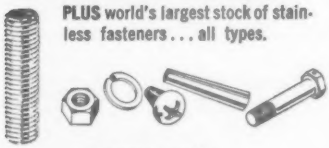

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State of Business, continued

Manufacturers expect to sell about 9% more products. If retail sales rise quarter-by-quarter in 1960, it is probable that present survey figures will turn out to be a little low.

The government will not be changing its budget outlays materially. State and local spending will rise slowly, an overall increase in governmental demand of $2-3 billion.

Autos? A good guess may be 7 million sales, including about 500,000 imports.

A threat to auto sales lies in consumer credit, which has risen at dizzy rates (up $5 billion in 1959). Consumers may not be in a mood to continue incurring debt at this rate, despite plentiful credit available. This may act as a moderate damper on durable goods sales.

Foreign trade balance of payment difficulties remain unsettled. Gold deficit losses went from $3.4 billion to $4 billion in 1959 and will not disappear this year.

Most of the world is prospering, and U.S. exports and imports should rise moderately this year. There is speculation that our exports may rise more. Steps taken by the British and others to terminate import controls are encouraging. Currency convertibility is now more substantial than at any time since before World War II.

The failure of world-traded raw material prices to rise is still reducing the importing power of many raw material producers.

It's nice to note that prices have been relatively stable for the last year-and-a-half, after rising continuously for about a year beginning with the onset of the 1957-58 recession.

Any upward pressures on price indices now are accounted for by increases in state and local taxes.

Whether stability will continue in 1960 will be governed heavily by the wage settlement in steel. This is not because of the importance of steel as a cost, but, rather because of its influence on other industries. The steel managements' determination to avoid another inflationary wage spiral will be severely tested in the weeks ahead, and if successful the country will be indebted to their efforts.

The Consumer Price Index is more likely to rise than fall in 1960, but at a rate not much different than in the last six months.

INDUSTRIAL PRODUCTION

In the money market, while the Fed is blamed in some circles for the rise in interest rates, it is the relative scarcity of loan funds which is the cause. In the first three quarters of 1959 the use of funds reached $41.3 billion, as against only $24.8 billion in the same 1958 period. If we had some debt retirement in 1960, interest rates would be under less upward pressure.

Loan fund scarcity may have come close to its peak. With housing starts down and the Treasury operating close to a balanced budget, more funds will be available for other purposes.

In summary, barring new, severe strikes, 1960 should be healthy. The fact that retail sales and non-steel sectors held up well during the steel strike, suggests much basic strength in the economy.

Gross National Product (GNP), about $485-90 in the fourth quarter of last year, should reach $520-25 billion in the fourth quarter of 1960. Personal income should rise by $25 billion.

Being an election year, political factors may condition the course of events, but economic forces and decision-makers have a way of discounting political noises. •

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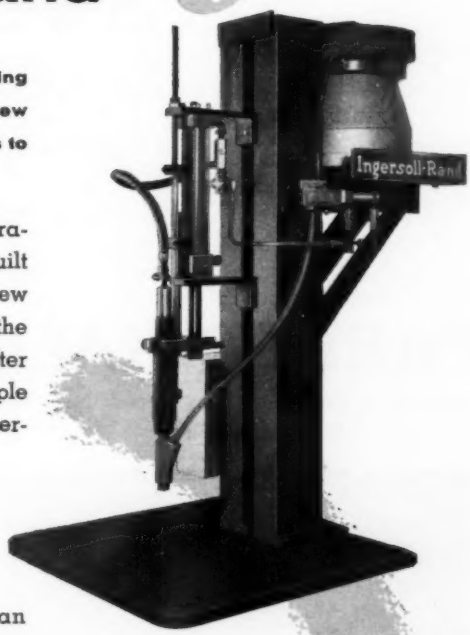
You get complete flexibility by moving, adding or removing powerheads—by varying screw types or sizes—or by adjusting power ranges to meet different torque requirements.

Now you can automate your fastening operations without buying expensive, custom-built fastening equipment. With the versatile, new R.A.F. Screw Driver, you can run one job in the morning, and a completely different job after lunch. Changing the screw pattern is as simple as loosening and then tightening two powerhead bolts.



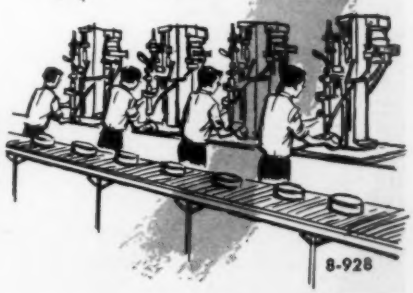
dividends on payroll dollars

Using the new R.A.F. Screw Driver, one man can outperform a half dozen operators using conventional hand held screw drivers. As an example of savings possible with Rapid Automatic Fastening, multiply the yearly wage you pay one operator by the number of operators the R.A.F. Screw Driver replaces. This figure, minus the cost of the R.A.F. Screw Driver, represents your Dividend on Payroll Dollars for the first year alone.

For the full story on Dividend Dollars with Rapid Automatic Fastening, call your local Ingersoll-Rand office today, or write for Bulletin 5266.

✶ in small shops

✶ on assembly lines



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there's nothing new in Socket Set Screws!

The revolutionary P-K W-POINT Socket Set Screw is not only new—completely new—it is capable of delivering the highest degree of holding power ever attained...at no increase in price!

What's the difference between the new P-K W-Point and ordinary cup point set screws? It's the new pivot point that's built into the cup! This exclusive P-K feature reduces "wobble" caused by the required tolerance clearances between screw threads and the tapped hole . . . minimizes "tipping" motion imparted by key tightening . . . creates tracking which is uniformly even in depth and shape . . . results in frictional engagement of both cup edge flanks . . . provides:

30% more back-out torque

50% more resistance to vibration

50% more resistance to rotary slippage

Test this new socket set screw in your own plant. Ask your P-K Industrial Distributor for complete information and samples today, or write to P-K direct for technical bulletin No. 1106.

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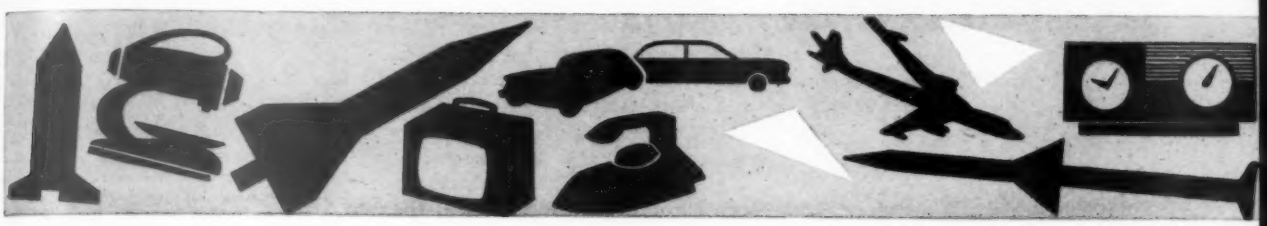
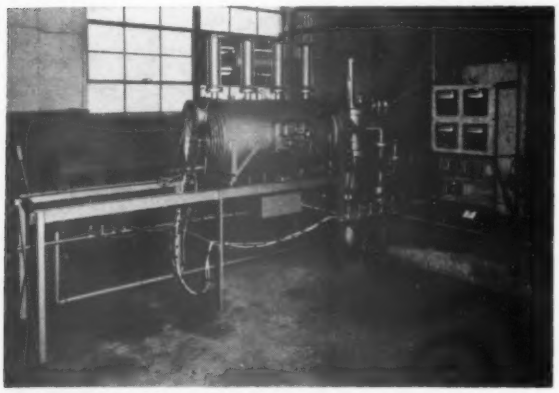
Industry at Work



GRUMMAN LEADS AIRCRAFT INDUSTRY INTO NEW HONEYCOMB BRAZING PROCESS



Pilot-scale unit can braze test-size panels 12"x24" by 1" thick. Cylindrical chamber rolls horizontally on twin rails, opens for loading by moving to the left.

Stephen Bukata, inventor of the process, places a cover sheet over the honeycomb panel, during the loading operation.

An aircraft manufacturer has ordered equipment which will make it the first in the aircraft and missile industry to production-braze honeycomb structures under vacuum.

Grumman Aircraft Engineering Corp., Bethpage, Long Island, will fabricate structures for the Eagle air-to-air missile, holding the sub-contract for the missile's airframe, propulsion system and ground-handling equipment.

The equipment Grumman will use, capable of brazing panels in excess of 50 square feet in area, is part of the Stokes-Bukata process announced late in 1958 by the F. J. Stokes Corp., Philadelphia.

In the loading operation, honeycomb is placed upon the reference base, a block of graphite, either flat or contoured as required. Heating elements extend across the unit's lower heating tray. Duplicate heating elements are provided in the upper heating frame mounted within the chamber.

A cover sheet is placed over the honeycomb panel. An O-ring gasket runs around the perimeter of the water-cooled heating frame and forms a vacuum-tight seal within this cover sheet. A similar sheet and O-ring are located beneath the reference base. Together they completely enclose the panel. When evacuated to a high vacuum, this provides an inert atmosphere suitable for brazing.

This process utilizes a new procedure which avoids any need for making welded "envelopes" to enclose the work. This permits the panels to be rapidly loaded and unloaded. The extremely high-vacuum atmosphere created in the Stokes equipment also eliminates the need for inert gas.

Why use vacuum in place of inert gas? A. D. Garwood, manager of Stokes' Vacuum Metallurgical Department, answers by pointing out that both the core and the skin in stainless steel honeycomb structures are oxygen-loving materials prone to form oxides that resist the achievement of a good bond. The use of inert gas such as argon merely substitutes a non-reactive molecule for an air molecule. These inert-gas molecules are bound to contain a certain amount of contaminants no matter how elaborately the gas has been dried. These

continued

FOR TIMESAVING ASSEMBLY OF SMALL PARTS

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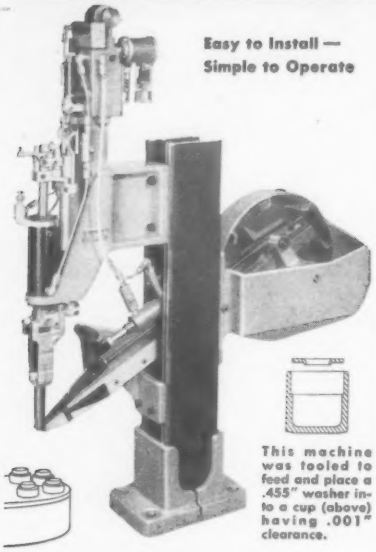
Auto-Positioner

IN FOUR STANDARD MODELS



Easy to Install — Simple to Operate

This machine was tooled to feed and place a .455" washer into a cup (above) having .001" clearance.

- *New Positive-Acting Feeder*
- *Automatic Sensing Device*

The Dixon Auto-Positioner is a compact, air-operated automatic assembly machine for parts from 1/16" to 2" size at speeds up to 6000 cycles per hour. It is furnished as a fully automatic station for use at a dial or in-line transfer table, or as a self-contained machine with pedestal and fixture table. There are four models, providing a selection of equipment to suit your requirements.

Dependable, Accurate, Compact

The new parts feeder is simple, compact (only 6 inches wide), and efficient. It provides positive advancement of the part into the chuck; it has a straight track and a positive-acting escapement; and it requires no separate motor or vibrator. Automatic sensing assures quality control. It interrupts the cycle when a part is missing or improperly assembled.

Standard Equipment, Easily Retooled

The chuck, positioning punch, and feeder tooling are easily modified or replaced for other jobs. Compactness permits close nesting at multiple stations, cutting cost of fixtures, dials, or transfer devices.

DIXON

Send for Bulletin AP-B2 or request our machine planning service.

DIXON AUTOMATIC TOOL, INC.
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Industry at Work, continued

contaminants contain enough oxygen to produce the unwanted oxides. Vacuum, on the other hand, is a true inert atmosphere —the best you can get per dollar of capital investment, according to Garwood.

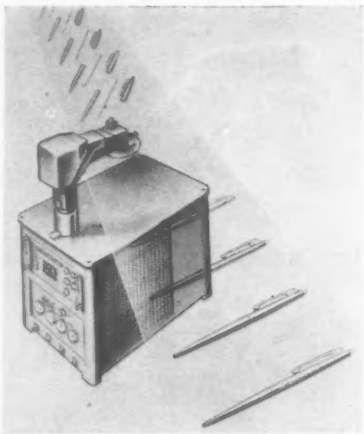
The equipment initially will operate at 1750°F, high enough for all present honeycomb work, and can be operated successfully at temperatures in excess of 2100° F. The equipment incorporates provision for cooling of the work once the brazing material has fused. This feature is especially desirable with precipitation-hardening type honeycomb materials, such as 15-7 Mo. and 17-7 PH stainless steels.

Both Stokes and the process inventor, Stephen Bukata, consultant on honeycomb brazing, express optimism for this approach on newer honeycomb materials such as titanium, molybdenum and beryllium.

The chamber is being closed against the fixed end-plate and evacuation will begin. During brazing, hydraulic cylinders in the top of the chamber force the upper heating frame down onto the cover sheet, firmly compressing the O-ring gaskets to seal the "envelope" around the panel.

LOOK FOR THE ROBOT ON THE ASSEMBLY LINE

A mechanical version of an arm and a many-fingered hand has an electronic "brain" which can be taught to handle parts, assemble components and operate machines.



The entire machine occupies six square feet.

It will perform many repetitive operations on such diverse products as toys and carburetors, cigarette lighters and typewriters, computors and guided missiles.

According to Edwin F. Shelley, president of Robodyne, it will be priced within reach of great numbers of manufacturers.

TransfeRobot was developed by the Robodyne Division of U.S. Industries as "a step forward toward the day when all routine manufacturing processes will be fully automatic," said John I. Snyder, Jr., board chairman.

A set-up and program panel in the base of the machine provides simple means of instructing and training the robot for a job. Training can be done in 30 minutes.

INTERCOM SYSTEM EITHER PARTY LINE, CONFIDENTIAL

An intercom system that serves as an inter-office party line or a confidential link for individual conversations was announced by the Radio Corporation of America. "In case of individual calls, the conversation cannot be interrupted by a third person, who must wait until a signal light indicates the line is no longer in use."

In addition to individual and conference calls, the system permits all-call communications and executive priority calls in which one unit takes precedence over all others.

If a call is made while the intended recipient is away from his desk, a light on his set indicates the person attempting to reach him. The caller can cancel this electrical message by pushbutton.

Because of its employment of transistors throughout, the RCA master and one-call sets require no warmup period and draw from the power source only when in actual use. •

flowability

MAKES THE DIFFERENCE

The specially shaped Nibs under the head of this Shakeproof® Thread-Cutting Screw are designed to act as torque brakes. As the screw is driven, the Nibs make contact with the work surface and "eat up" excessive driving torques. This prevents stripping the threads from over-tightening and also permits a broader range of driver settings.

For effective braking action, each Nib must be sharp and precisely formed. So, material must flow deep into the die cavities to fill out each Nib. Keystone XL Wire does the job—uniformly, consistently and precisely.

There are many other examples of how Shakeproof puts the *flowability* qualities of Keystone XL Wire to good use, increasing production and quality. If you'd like to learn more about these qualities, call your Keystone representative. Our metallurgists are at your service.

Keystone Steel & Wire Company, Peoria 7, Illinois

Sems-by-Shakeproof—5⅛ diameter head plus shoulder makes this a good example of the *flowability* of Keystone XL Wire.

Mounting Screw combines left- and right-hand threads on the same shank as well as Nibs under the head. Left-hand thread and extruded lower thread section make this an exacting job.

KEYSTONE XL WIRE STUDY

KEYSTONE

WIRE FOR INDUSTRY

Use postpaid card. Circle No. 308.

Technical-ities

By John S. Davey

The choice between a cap screw and socket head screw

If you have the choice, make it a socket screw when you have a space problem, but choose the cap screw for more holding power per dollar.

No question that you should apply socket screws in counterbored holes; and that you can clear tight spaces. What you can't do is utilize the full strength of the alloy needed for the socket head. And remember, strength of a connection depends on how you preload the fasteners, and not on the strength of the fastener material alone.

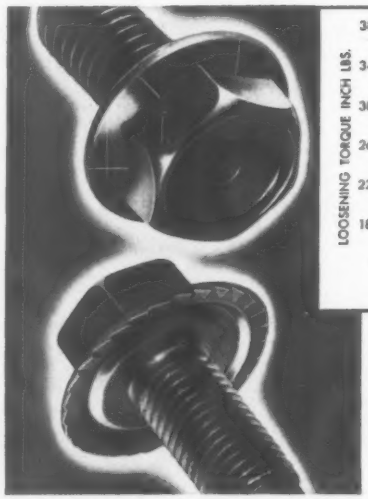
THE HANDICAPS OF ONE

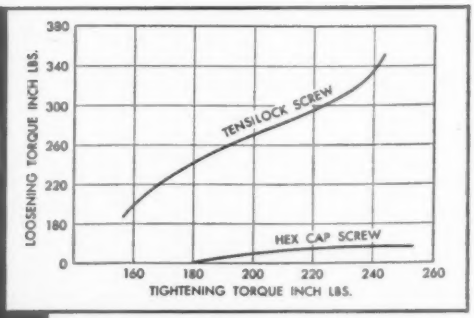
Internal wrenching rarely develops as much torque as needed for proper preloading. And if high torque is developed, the smaller bearing area of the socket head tends to crush the surface on which it bears rather than increase tension or preload.

THE ADVANTAGES OF THE OTHER

If you design to take advantage of heat treated cap screws of SAE grade 5 quality, you'll get a stronger connection at lower cost. These standard fasteners have ample bearing and wrenching surfaces, can be torqued right up to yield strength. They also cost less than the alloy fasteners.

New TENSILOCK* Screws seat tighter, lock tighter





Graph shows example of on-torque and off-torque relationship. It takes more torque to loosen than to tighten.

RB&W's new TENSILOCK screws, the toothed fasteners with high tensile locking, are identified by six radial dashes on flange.

Head has integral washer face with teeth that lock fastener to surface. Circular groove allows flange to flex and seat to bear solidly on surface.

RB&W's TENSILOCK fasteners feature ratchet-like teeth formed at an angle which cuts driving effort yet which enables the teeth to bite in firmly and give an improved grip against back-off.

In addition, a circular groove in the integral "washer" permits the flange to flex upon tightening, and helps maintain tension in the fastener and pressure on the teeth.

IMPROVED TENSION TO TORQUE RATIO

With reduced friction under the head, the new tooth design has enabled more of the wrenching torque to be used to develop tension and less to overcome friction. Since the flange flexes, it allows the screw to bear solidly on its seat. All of the high strength capabilities of these heat-treated one-piece fasteners can now be attained for a stronger assembly.

MORE LOCKING POWER

Tensilock screws need up to 40% more off-torque than on-torque. Combining this feature with the higher residual tension, and the diaphragm action of the integral washer face, these fasteners give superior locking and holding power for permanently tight, strong joints . . . even under severe vibration and cyclic temperature changes.

Now available in limited range of screw types (not in flat head), and in various nut sizes. For details, write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

* Trade Mark — Pat. applied for.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa., Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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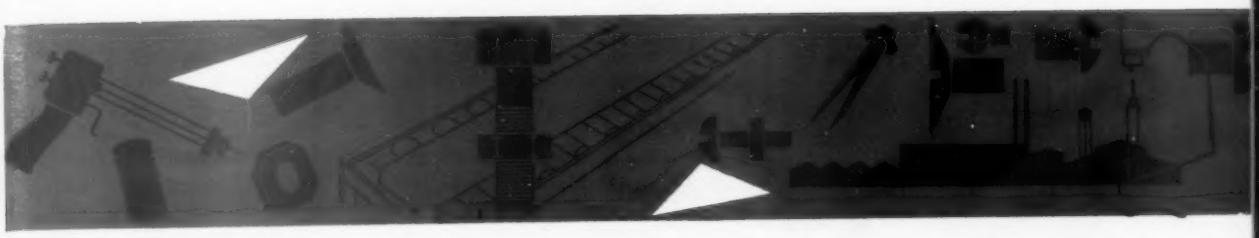
Assembly and Fastening Ideas

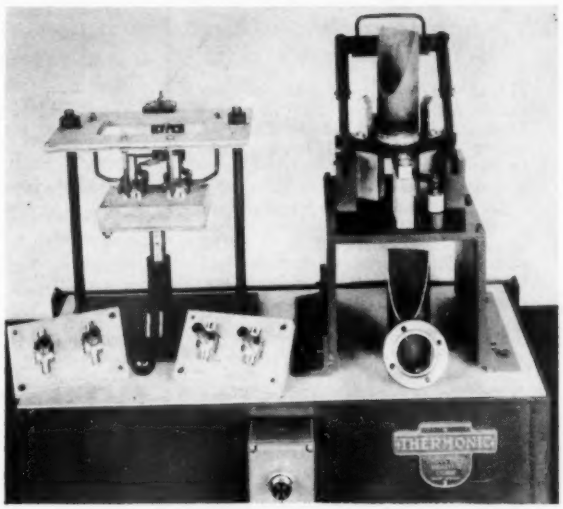


ONE SETUP BRAZES FOUR VALVE ASSEMBLIES

Valve bodies are being brazed safely, quickly and easily with a "production line" setup at the Standard Machine & Mfg. Co. of St. Louis.

Devised by Induction Heating Corp., Brooklyn, the setup brazes two brass parts every 40 seconds and one steel part every 30 seconds. The sleeve is brazed to the body without damaging the finished threads.

Three sizes of brass assemblies are worked with the same coil, with slight in between adjustment of fixture height and time cycle. Brazing of the sleeve to the flange can be done with equal accuracy. Holding and locating fixtures, made of Electrobestos, are pre-loaded and placed on the platform which lifts the parts up into the coil. The standard table is bolted to the front of the combination generator stand and heat exchanger housing.



CURRENT-PATH VERIFIER SAVES TIME

Manufacturing research engineers at the Boeing Airplane plant in Wichita, Kansas, can approach a mass of complex wiring in the B-52G and identify individual wires in a matter of seconds. The secret is an aluminum case smaller than a shoe box.

The recently-designed portable current-path verifier, build especially for aircraft applications, saves much time in electrical checking during final assembly.

There are 651 wire bundles in the missile platform bomber, connecting its electronic elements. In many cases, multiple-strand cables of wires have pinned connectors at each end. Each connector may have as many as 51 terminal pins, and after these are soldered to the cable wires, the bases are embedded in potting compound. Methods for checking on whether a pin on one end of the cable is properly connected to the correct pin on the other end are routine and well established.

continued

It's easier and less costly to buy Mellowes Lock Washers

because MELLOWES accepts orders "LONG DISTANCE, COLLECT"

When you need lock washers in a hurry, all you have to do is phone Mellowes long distance, "collect," at Milwaukee, Wis., East Orange, N. J., or San Francisco, Calif.—whichever is nearest you!

If your order calls for standard sizes and sections of Mellowes Lock Washers in Coin Pak, JOB-PAK, standard packages, or bulk, it will be shipped within 8 hours from time received. Mellowes maintains a complete stock of standard sizes and sections at all of its warehouses.

If you are located within 500 miles of Milwaukee, East Orange or San Francisco, you can expect "overnight delivery" of your lock washer orders. They are shipped *via a fast carrier* to eliminate the need for follow-up. And, if the order is 200 lbs. or over, the freight charges will be Prepaid by Mellowes.

Call Mellowes Long-Distance Collect to place your orders for Lock Washers — at these numbers:

East Coast Warehouse
519 Main St. East Orange, N. J.
ORange 6-0714

Mid-West (Home Office)
125 E. Nash St. Milwaukee, Wis.
COncord 4-5090

West Coast Warehouse
975 Indiana St. San Francisco, Calif.
ATwater 2-2600

You'll find, as others have, that it's easier and less costly to buy your lock washers from Mellowes because Mellowes accepts your rush orders via "long distance, collect."

The Mellowes Company
143 E. Nash Street • Milwaukee 12, Wis.
Call Long Distance, Collect!

A. W. Mellowes,
Founder and Chairman of the Board

Note:
This is one of a series of advertisements presenting Mellowes customer-service policies which benefit you, the buyer of Lock Washers.

A9-2029

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But in some phases of final assembly, the continuity information is not enough. Checkers must verify that current is flowing through the correct wire.

The five pound sensing device has a hinged iron element that opens and closes like a pair of pliers. This is wound with a multi-turn coil. When the iron is closed around a "hot" wire, a voltage is induced into the coil. Through the use of a miniature thyatron tube a small neon lamp is made to glow. Choice of the low-powered tube allows the device to operate on two small batteries.

Because the unit is compact and free of power-supply cords, it can be moved easily from job to job, and used where space is limited.

NUMERICAL CONTROLS PROVIDED FOR ASSEMBLY OPERATIONS

A completely transistorized, two-axis numerical machine tool control providing discrete positioning to turning, drilling, eyelet inserting, punching, riveting or spot welding operations has been displayed at Hughes Aircraft Company's industrial systems division.

The digital control utilizes mercury-wetted relays to provide long life and high reliability, and has electronic photocell position transducers. A single compact cabinet houses the photocell tape reader, operator control, and electronic circuitry.

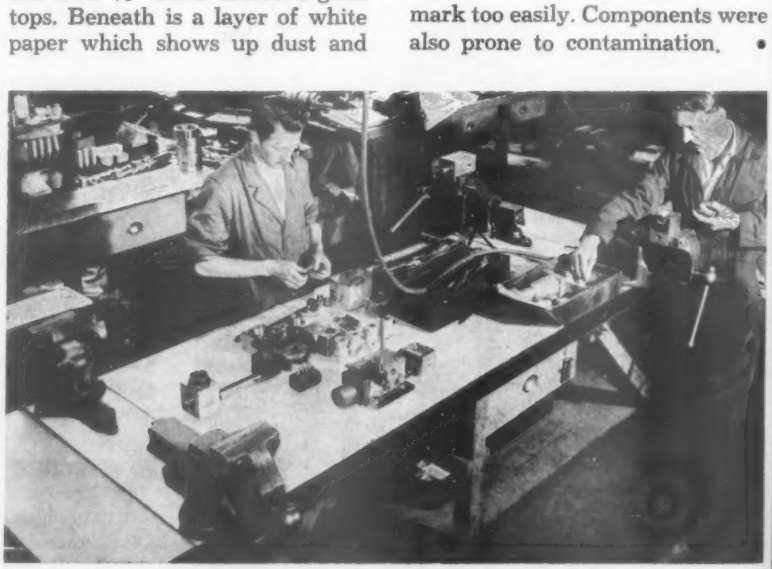
"A unique Hughes creep-traverse drive unit assures accurate positioning every time, with high speed positioning at 180 inches per minute," according to Dr. William Leone, division manager.

Repeatable accuracy is .0002" or better. To allow for initial checkout of runs, the control can be set to operate manually and semi-automatically, as well as fully automatic. Because of the low power requirements of the transistorized circuitry, total power requirements for the Hughes control unit have been greatly reduced. Control plus drive motors require less than 7 amps. A third axis feed control can be added to the unit, if desired.

PAPER UNDER GLASS ILLUMINATES DUST ON ASSEMBLY BENCH

Simple but effective is the method one English firm uses to detect dust particles. Benches used for the assembly of hydraulic pumps and valves at Towler Bros., Rodney, near Leeds, have been fitted with ¾" thick armored glass tops. Beneath is a layer of white paper which shows up dust and permits it to be kept from getting into mechanisms.

The glass is sealed to the metal frame to prevent oil seeping on to the paper. Wooden and aluminum tops were tried but were found to mark too easily. Components were also prone to contamination. •

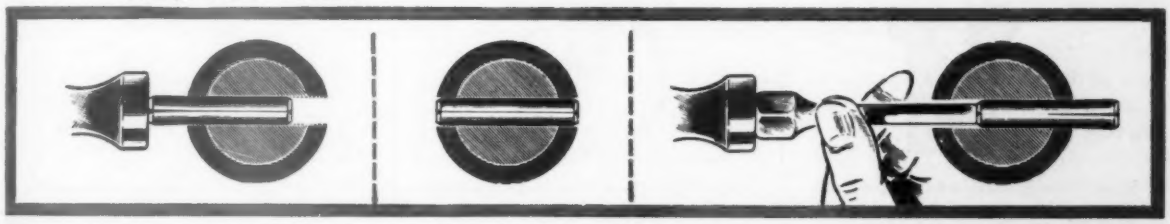


what makes this fastener DIFFERENT?

Several things. Rollpin® is a slotted, chamfered, cylindrical spring pin which drives easily into a hole drilled to normal production standards. It locks securely in place, yet can be drifted out and reused whenever necessary. This eliminates special machining, tapping, and the need for hole reaming or precision tolerances. Rollpin replaces taper pins, straight pins and set screws; for many applications it will serve as a rivet, dowel, hinge pin, cotter pin or stop pin.

And here's another difference that makes Rollpin the quality fastener in the field: ESNA's quality control builds consistent strength and performance into every Rollpin. Rollpin is uniform as to shear strength, dimensions, hardness, and insertion and removal forces.

HOW YOU INSERT IT



Drives easily by hammer, arbor press, or air cylinder and can be readily adapted to an automatic hopper feed. Requires only a standard hole, drilled to normal production-line tolerances.

Locks securely in place without using a secondary locking device; won't loosen despite impact loading, stress reversals, or severe vibration.

Removes readily with a drift pin without damage to pin or hole, can be used again and again in original hole.

HOW YOU SAVE

You pay less for Rollpins than for most tapered, notched, grooved or dowel pins. Installation costs are substantially less than for any fastener requiring a precision fit or secondary locking operations.

Because of their tubular shape, Rollpins are lighter than solid pins. Production maintenance is reduced with Rollpins: they do not loosen and because of their spring action they tend to conform to the drilled hole in which they're inserted, without material hole wear, eliminating the necessity of re-drilling or using oversize pins.

MATERIALS AND SIZES

Standard Rollpins are made from carbon steel and Type 420 corrosion resistant steel. They're also available in beryllium copper for applications requiring exceptional resistance to corrosive attack, good electrical, anti-magnetic, and non-sparking properties. Stock sizes range from .062" to .500" in carbon and stainless steels.

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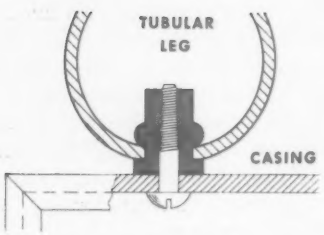
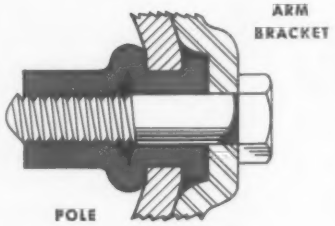
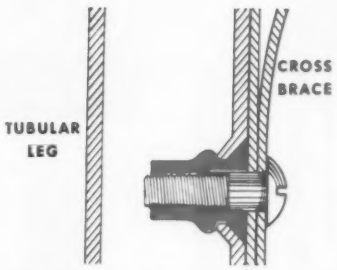


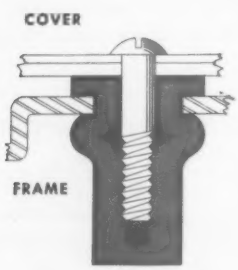
One man installs Rivnuts from one side in seconds—speeds assembly of *barbecues*. Permanent nutplates in legs save time in faster knockdown, too.



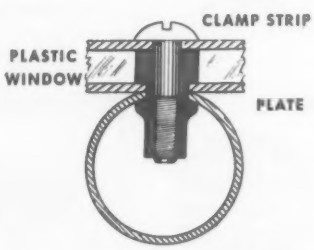
One man does the work of two, assembling arm brackets on *light poles*. Tests show pole or arm will fail before Rivnuts.



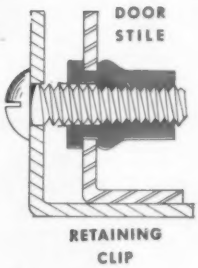
Clean, functional lines of modern *furniture* are preserved by Rivnuts. Upset inside tubular legs, they replace unsightly nuts, bolts and screws.



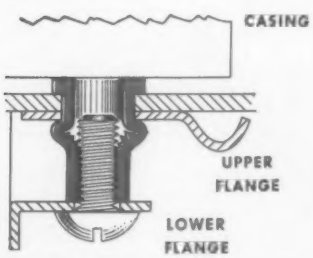
Rivnuts enable repair men to remove top of *automatic washer* and replace it easily. And Rivnuts can be installed after enamelling.



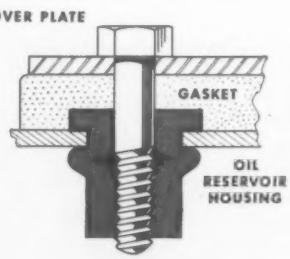
Upset Rivnuts secure *airplane window* plate to center post. Bulges in shanks seal out weather. Heads of Rivnuts serve as spacers for plastic window.



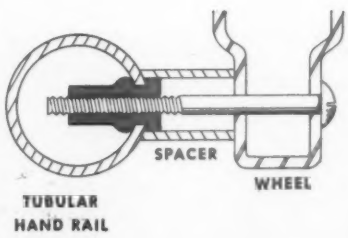
Rivnuts replace self-tapping screws used to hold retaining clips on aluminum *storm doors*, provide firm nutplates that won't loosen with shock or vibration.



Rivnuts eliminate need for reinforcing plates in *vaporizers*. In addition, Rivnuts space bottom flange automatically, prevent bending.



Assembly time for *oil reservoirs* is cut in half. Rivnuts eliminate welding, tapping and cleaning previously required to attach coverplate.



Wheel chair designers needed a blind nutplate with at least 6 clean threads. Rivnuts, only one-piece blind rivets with threads, were the answer.

Special fastening problems? B.F.Goodrich Rivnuts solve them. Send for free demonstrator. Dept. AM-98, B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.

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SPRING PIN SOLVES IRONING BOARD FASTENING PROBLEMS

By switching to a spring pin to join the steel legs of its ironing boards, Proctor Electric Company, Philadelphia, improved the stability of its product.

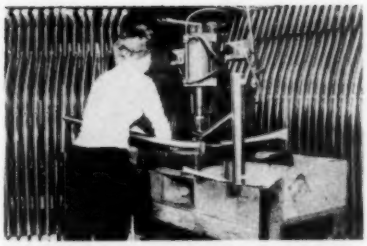
The tubular legs are fabricated from strip, reinforced, pierced for the pivot pin and contour-formed. But the hole pierced on the far side of the tube is not as clean as the hole on the near side, because the slug punched out from the first hole rides on the tool face and punches out the second hole.

Steadier ironing boards were the result when a spring pin was used to join the legs.

Contour-forming accentuates the difficulty. As legs are curved, one hole elongates while the second foreshortens. The result was play in the fit. A separate hand reaming operation was necessary to round the holes.

Proctor experimented with the SPS Sel-Lok and found that the slotted, tubular pin, compressed as it was driven into the slightly undersized hole. It automatically compensated for any wear in the hole.

In the changeover, from a solid pin, savings of $.02 cost per pin were realized. Eliminated also was the reaming operation. In the first year Proctor has reported lower costs of $8600.



On this simple assembly set-up, force-fit spring pins are inserted into ironing board legs.

In assembling the pins, the girl operator lines up the curved ironing table legs by putting them on assembly-fixture locating pin, putting spring pin (already capped on one end with a cap nut), in the air driver, then presses the button. Driver inserts pin, then retracts, while operator puts rubber snubbers and other needed items on the feet.

CARBIDE RIVET TOOL CUTS COSTS BY ASSEMBLING 36,000 PIECES BEFORE MAINTENANCE

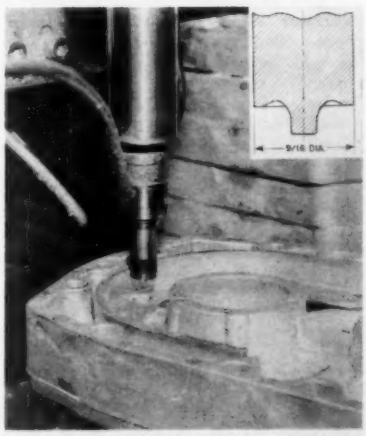
A change of material in a rivet spinning tool used to assemble a part in a die cast aluminum housing eliminated more than 97% of former tool and maintenance costs by the time the first 36,000 pieces were assembled, saving $1338. The additional first cost of the tool was repaid before 1000 pieces had been assembled.

The new tool also produces a better finish and has eliminated the tearing of rivets caused by the tool galling which had caused many rejects. The saving in machine downtime was 14 hours during the initial run.

The riveting operation, employed in the Indianapolis plant of a major manufacturing company, consists of cold spinning five aluminum rivets which fasten a horseshoe shaped part in the housing. The rivets are 5/16″ in outside diameter and have a 1/16″ wall. Riveting is performed during an automatic cycle with the tool spinning at 3600 rpm. The sequence starts with a light contact to heat up the rivet. The tool is then retracted enough to permit mist spray lubrication, and moved down again to complete the riveting cycle.

The riveting tool is now a hard carbide, Grade K82 made by Kennametal, Inc. It was first reconditioned after production of 36,-

continued



A carbide tool 9/16″ in diameter and 3-5/16″ long, with a riveting head on each end, is saving $37.17 per 1000 assembled housings over previous tool for one manufacturer.

000 pieces. The total average production of the high speed steel tool formerly used was only 2000 pieces after reworking ten times.

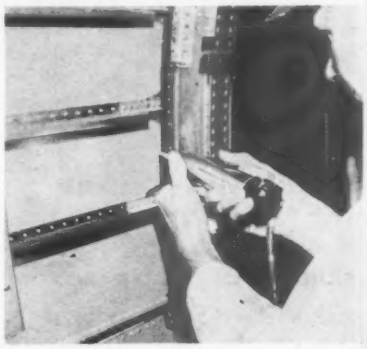
FAIRCHILD SEALS THE F-27 WITH MINIMUM ASSEMBLY DELAY

Assembly flexibility is a must for the Fairchild Engine & Airplane Company in building its twin-engine F-27 to order. In a small plant area the company can turn out from 2 to 20 planes a month.

An example of fitting materials and methods to these needs is the company's way of sealing integral fuel tanks in the wings and cabin sealing.

The smooth flow of the polysulfide liquid polymer base sealant from compounding room to assembly areas and the techniques for rapid application have added to the production economy and reliability of the F-27.

Thiokol-supplied sealants are machine mixed in five gallon batches, then extruded into polyethylene cartridges. Each is quick-frozen at -100°F to prevent premature curing.



This door frame is sealed, as are all other door and window openings in the pressurized cabin structure.

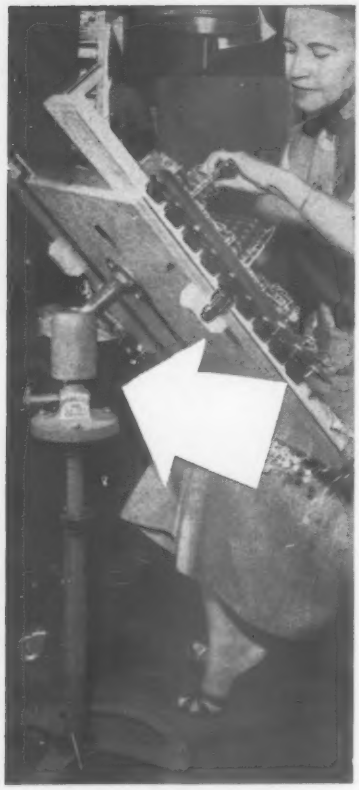
Samples of each batch are tested as a part of quality control.

In the assembly area, cold boxes are provided for storing the materials close at hand. The application is made in three operations: joint areas and rivet heads are cleaned with a solvent to assure sealant adhesion to the metal; a primer coat of sealant is brushed on the points and around the rivets; a fillet of sealant is applied from a caulking gun, then leveled for continuous seal.

The wing structures are set aside for curing, then moved on for further assembly, additional sealant being gun-applied as new joints are made. The aluminum fuselage skin joints as well as openings for doors and windows are also sealed. •

Joints and rivet heads in a wing spar are brush coated, then sealed with a heavy fillet.

The short-to-medium range F-27 first went into service September 1958 for West Coast Airlines. It is built for both commercial airlines and private corporations.



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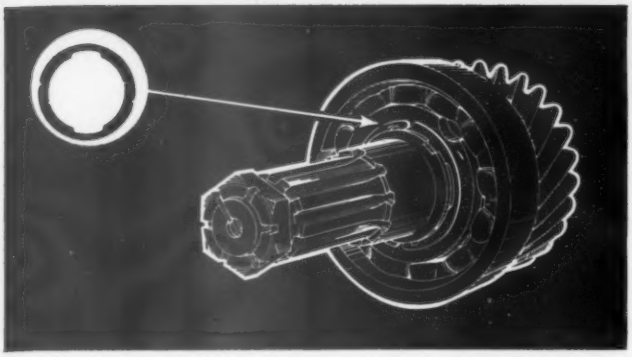
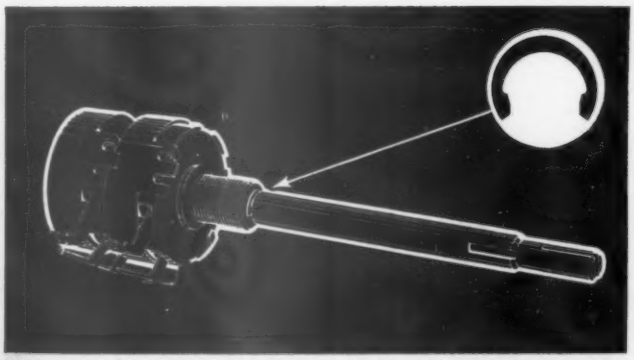


Heavy duty transmission design simplified. On this dual axle drive for trucks, a Truarc Series 5107 ring locks bearing on drive shaft. Interlocking ring design won't dislodge under heavy torque . . . is also recommended for high rpm. applications.

Rings replace machined shoulders, collars, set screws. That's what original design of this pneumatic temperature transmitter called for. Series 5139 Prong-Lock® ring with bowed design compensates for accumulated tolerances in parts, provides sufficient friction to prevent rotation under vibration. At the same time two Waldes E-rings position and lock adjustment screw to face plate.

Reinforced aluminum ring gives design advantages on louver windows. Waldes Truarc Series 5144 reinforced rings of aluminum secure hinge pins, eliminate costly riveting in linkage of louver type window. Ring design provides large bearing shoulder. Reinforced construction has 5 times the gripping strength of standard E-ring construction, allows use of non-corrosive aluminum.



Ring acts as locking shoulder. Holding the threaded ferrule on this potentiometer shaft is a Truarc Series 5103 Crescent® ring. Crescent ring design with low shoulder provides ample clearance for assembly of panel locknut. It is less costly than a machined shoulder, more effective, quicker to install, easier to remove than the C washer previously used.

Designing with radially assembled Waldes Truarc retaining rings

solve varied product design problems—save machining, materials, parts and labor

Radially assembled retaining rings, which snap onto a shaft at right angles to its axis, greatly extend the range of products on which retaining rings may be used to simplify design and save parts or labor costs.

For example, rings for radial assembly can be used in applications where it is impossible to install a ring axially over the end of a shaft. Certain types are designed to accommodate shafts of relatively wide tolerances. Others described below may be used to provide a sizeable shoulder on a shaft.

The four applications shown here provide an indication of the wide range of products using radially assembled rings. The rings themselves are basic Truarc types each having specific design features. The high shoulder of one provides a large bearing surface on small diameter shafts; the low shoulder of another is ideal where clearance is limited. A third has an interlocking design which prevents it from being dislodged under torque or high rpm. A fourth can be used against rotating parts at the same time it provides spring tension.

These are but four of Truarc's fifty functionally different types of retaining rings with up to 97 sizes within a single type, six metal specifications and thirteen different finishes. Special hand, magazine, and semi-automatic applicators as well as grooving tools are also available to speed production. The entire line, together with over 70 typical applications, is described and illustrated in the new catalog RR10-58—yours for the asking. And call on us for design assistance on your specific project . . . a Waldes Truarc engineer will be glad to help. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

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HOW HOTPOINT P

by **Darrell Ward**
Engineering Editor

A paced, ass-production assembly line turning out dishwers in Hotpoint's Milwaukee plant can balance the wrk load for any model unit on the same line, alternately at random, without changing conveyor speed or manower on the line, itself.

In actual practice, this controlled assembly line can produce as many as 12 different models in 5 different colors without changing a man or conveyor speed on a particular schedule—right up to the point of final inspection.

How does paced production work? The daily production schedule is the only thing which dictates the output in number of units. Everything else revolves around this requirement.

The pace of the line is regulated by the conveyor speed to deliver the scheduled output, whatever it might be. When this is established, the motion time elements are distributed as evenly as possible among the work stations, with sub-assembly elements being utilized to overcome unassigned time. Unless these facts were true, a paced line would not exist and output could vary considerably at different times and from numerous factors.

A paced production line begins where time study leaves off, but basically it is considered very simple. First, it is necessary to measure all work required in the assembly of one unit. Each combination of motions which comprise an element are established as unit elements of the total assembly. While time study must include every motion: reaching, grasping, moving part into place, etc.; a group of such motions necessarily must be combined to perform a work element. This is the unit element of work which is assigned to a particular work station.

This controlled line can produce up to 12 model units, alternately or at random, without changing a man or conveyor speed on a particular schedule.

T PACES ASSEMBLY WITH SALES

From the required schedule, it is easy to determine how fast a line must move. For example, assume that 225 units are to be assembled in a normal work shift of 480 minutes. Allowing 30 minutes down time for breaks, there would be 450 minutes actual operating time for the conveyor. So, obviously, with 450 minutes of operating time and 225 units to be run, each unit requires approximately 2 minutes to pass a work station.

This indicates how many work stations are required (at 2 minutes per station) for the total measurement of work content in one dishwasher. Total measurement is then distributed as evenly as possible among the various work stations.

If a station should prove to be out of balance in assigned time because of the sequence of assembly operations, adjustments can be made for better balance.

Illustrations of this are the power pack and the door. Both of these components may require more careful attention to quality control. The power pack must be accurately aligned and properly torqued. The door must seal perfectly to avoid any possibility of leakage. The work stations where these sub-assemblies are installed on the final line could conceivably become heavy work stations. Work time might extend beyond the assigned period. Then, the situation must be changed. Some of the sub-assembly elements from that station can be reassigned to relieve the problem.

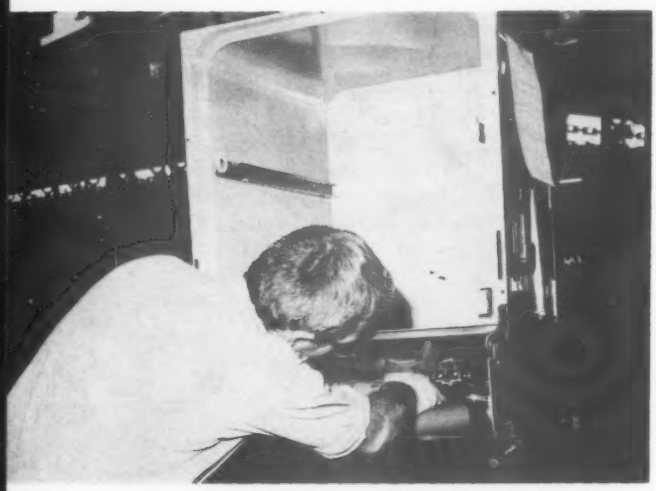
In the balanced line or paced production, there is no true bottleneck. There is only the theoretical bottleneck of 2.0 minutes, not the actual bottleneck of a unit being held up. The entire conveyor line is continuous and moves at the fixed rate. No bottleneck in the usual sense can exist because all units are moving the same at all times. The only thing that could happen, if a worker works out of pace with the rest of the line, is for a unit to come through incomplete. This would be caught on inspection and testing.

The line normally would be loaded for work performance at the rate of 2.0 minutes per work station. The line is paced at a 125% performance level so that when the schedule is met, a 25% incentive is earned. This is understood by all the workers on final assembly because they each draw the same incentive from the same line. No worker can work faster or slower—unless he is to stand around waiting for the next unit or fail to install all the parts he is required to install.

continued

Installation of legs and dish rack tracks comprise combinations of sub-assembly work at the first station. The unit is hung on the overhead conveyor by its legs.

This dishwasher gets a rotor-type power pack.



Different model units can be assembled in succession without disturbing the controlled line. Here an impeller-type power pack is installed (top and bottom).

Hotpoint Assembly, continued

Each work station is built up to the maximum rate by reassigning specific elements of the job. Any station can vary under but never over. An effort is made to build as close as possible for good balance.

Before the paced production system was set up at Hotpoint, additional work added through engineering changes or test requirements brought immediate requests for additional time.

The unique feature of the balanced system is that any work station requiring less than the theoretical bottleneck of 2.0 minutes allows the difference in unassigned time for additional work. Take a hypothetical example of 5 work stations:

Station No. 1 is built up with elements which add up to 1.87 minutes.

Station No. 2 is built up with elements which add up to 1.91 minutes.

Station No. 3 is built up with elements which add up to 1.82 minutes.

Station No. 4 is built up with elements which add up to 1.96 minutes.

Station No. 5 is built up with elements which add up to 1.82 minutes.

Suppose that because of a change of some kind, another .27 minutes of work are required and should be added to operations being performed at work station No. 3. This would then make station No. 3 run 2.09 minutes or .09 minutes in excess of the theoretical bottleneck. This cannot be done.

The solution to this problem is to remove some of the previous work assigned to work station No. 3 and reassign these elements to any of the other stations, provided the total time at any station will not exceed 2.0 minutes. Once you become accustomed to this system, Hotpoint engineers told us, it is relatively easy.

Sometimes the additional work cannot be redistributed without exceeding the theoretical bottleneck at one or more stations. If this occurs, then some of the previously assigned work can be removed from the final assembly line so that it can be performed by sub-assembly operators, either to feed directly to the line from nearby, or from another convenient area. And, if a work station is light in work content, work can be brought into the final assembly line from the sub-assembly operations.

Sub-assembly work at Hotpoint is not paced for balanced loading with a fixed conveyor speed as in the final line. Sub-assembly is on an individual incentive. Supply and demand are regulated by the foreman. A worker will be assigned so many units to build. When he gets finished with those, he checks with the foreman for the next assignment.

Power packs and doors are built up as sub-assemblies and supplied to the line as required. Final assembly on these components normally amounts to nothing more than fastening in place. If any work stations are light in work content, then portions of the sub-assembly work on power packs and doors, or all sub-assembly on such components as the rotor, rack tracks, and baskets can be reassigned to final assembly work stations. The fact is, all of these have,

at one time or another, been in the final assembly line and in sub-assembly as such needs occurred. The same is true of some portions of the door and portions of the power pack.

It is essential that workers recognize and accept the standard times established for measured elements on each job. Hotpoint goes a step further. Methods layout charts are conveniently located at each work station to spell out these details for the worker. Every operation is itemized to show the worker exact details of his functions on all work, how to perform the work, and how much time is allowed for each element. There is no covering up. The whole job is faced squarely by management and employees alike. Therefore, no legitimate grievances of the usual nature can be lodged against vague or misunderstood work elements. Most common differences are likely to be found in agreement over accurate measurement of elements or on the basic rate of pay.

If you consider this kind of system for your own production line, you must remember that where machine operations are involved rather than hand assembly, mechanical limitations may establish realistic bottlenecks regardless of human elements and incentives. Therefore, the slowest machine operation will govern bottleneck time for the entire line.

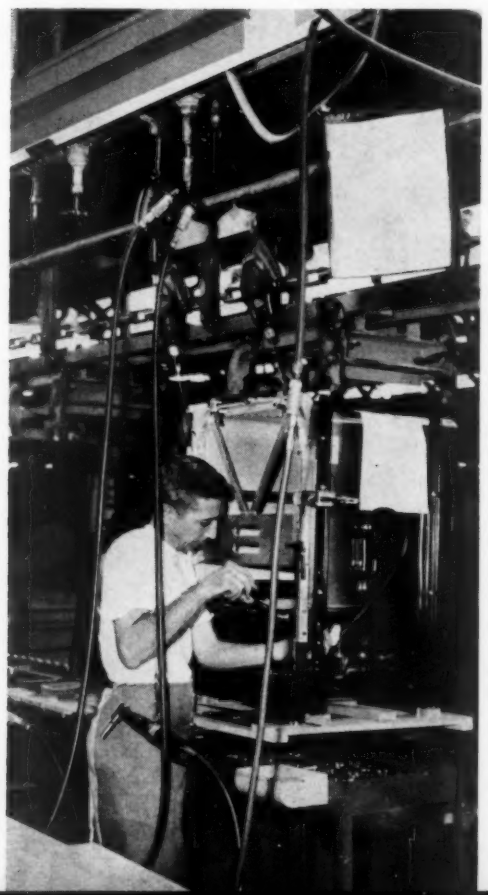
If the line is not limited by machine bottlenecks and is dependent upon the efficient effort of individual workers; and, if the line can be regulated to a fixed conveyor speed as required by production schedules, a paced production assembly line can be set up. It can run for 8 hours per shift, 5 days a week, producing a wide variety of units without ever running into a bottleneck—once the line is properly engineered.

It makes little difference what you make or what your schedule demands within reason. If you have a continuously variable conveyor, accurately measured elements of all work performed, and an understanding of the system, paced production may perform near-miracles for you at rates of 10 units or 100 units per hour. And, your schedule may conveniently vary, geared precisely to your supply and demand. •

Sub-assembly (installing gasket) can be done in the area of the conveyorized final assembly.

After installing the gasket, the same worker installs the door on the unit in conveyorized line.

Methods layout charts are placed at each work station showing details of all functions of the work, how to perform the work, how much time is allowed for each element.



Cleanliness is a key word in describing the pressurized assembly area at AiResearch. When tight-sealing doors to the plant's machining areas are opened, metal dust can not drift in against the air pressure. Here is shown a portion of the specially-partitioned assembly room.

AIRESEARCH ASSEMBLES PRECISION PRODUCTS IN PRESSURIZED ROOM

Meticulous control at AiResearch assures maintenance of high assembly standards for sensitive valves and turbochargers which have rotating units operating as high as 50,000 rpm

by **William D. Engstrand**
West Coast Editor

Assembling diesel engine turbochargers at The Garrett Corporation's AiResearch Industrial Division, Inglewood, California, is a complicated and precise process. Yet the facilities and techniques for accomplishing this work have been refined to a point where the major problems are neatly resolved by a series of well-planned sequential assembly operations.

A description of the turbocharger itself will best illustrate many of these problems. In service, the unit is mounted directly on the diesel engine and used to compress the intake air, thus increasing engine efficiency and power. It is powered by the exhaust gases from the engine which act to rotate the turbine wheel. The turbine wheel is mounted on a single shaft with an impeller wheel which draws in and compresses the engine intake air. Environmental conditions under which the turbochargers must operate vary all the way from dusty or muddy construction projects in all parts of the world

through the myriad of conditions which may surround various fixed diesel power plants.

Operational speeds of the units, dependent on type, vary from 40,000 to 80,000 rpm. This fact alone illustrates the necessity for micro-balancing each of the rotating units during the assembly operations. It also makes obvious the necessity of eliminating all dirt and dust from the high speed bearings during assembly. Clearances between the rotating units and housing must be closely controlled to maintain turbocharger efficiency, and this is another problem that rests squarely in the assembly department's lap.

As might be imagined, very high precision parts are delivered from the AiResearch machine shop to the assembly department, and subsequent assembly must be accomplished in a manner to reflect this precision in the finished product.

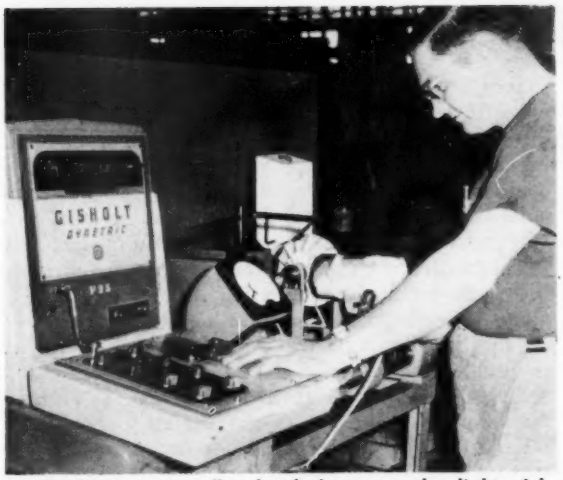
To facilitate the work, AiResearch engineers recently completed installation of a "clean" room in which most of the assembly operations are performed. This room, with doors which effectively seal when they are shut, is kept slightly pressurized with filtered air at all times. Thus, when a door is opened, there is always an outflow of air from the assembly area, never an inflow to bring with it airborne dirt and dust from other portions of the plant.

The value of this clean room is well illustrated by the fact that turbochargers assembled in it are rated at a higher continuous top speed than the same turbochargers assembled under ordinary shop conditions. This means increased product efficiency.

When turbocharger component parts leave the machine shop, they move directly into the cleaning department. Here various methods of cleaning are employed, dependent upon the part and its subsequent use. Most parts are spray-cleaned in a spray booth, using a double-purpose solution which not only cleans, but applies a phosphate surface treatment as well. High speed rotating parts are vapor blasted to improve their overall surface finish. Parts containing oil channels are immersed in a hot detergent solution while compressed air is blown through the various channels for approximately 8 minutes. The solution agitation caused by the compressed air effectively cleans all cutting fluids and other machine shop debris from these hidden orifices.

After cleaning, the turbine wheel, impeller wheel, and the shaft on which the two will be mounted, go directly to the balancing department. Here the impeller wheel is mounted in a Gisholt Dynetric balancing machine and whirled at high speed for balancing. The mounting shaft in the machine is numbered around its periphery just adjacent to the wheel being balanced. A strobe light plays upon the mounted wheel while it is spinning. This strobe is synchronized so that it flashes each time a portion of the wheel that is causing unbalance comes into a certain position. The same flash illuminates the number on the mounting shaft. The operator notes this illuminated number, and when the machine is stopped, marks on the wheel where material must be removed to bring it into balance. This is accomplished in a small milling machine which

continued



In checking an impeller for balance, strobe light picks up a number on the mounting shaft so the area causing unbalance can be noted for removal later in a small milling machine.

After superfinishing journal-bearing areas on shaft, the impeller and turbine wheel are shrunk-fit on the shaft in oven at left. Worker at right is installing rotating assembly in a portion of turbocharger housing.

A fixture-mounted dial gauge is used to check clearance between the rotating assembly and turbine housing. Fixture duplicates interior contour of turbocharger housing.

shaves away the surplus metal in the designated area.

After balancing, the impeller wheel is anodized. Meanwhile, the turbine wheel, a machined cast component, has been brazed on the turbine shaft. The anodized impeller wheel is then heated to 350°F. and press-shrunk onto the opposite end of the shaft.

This entire assembly is then balanced, following the same techniques used for the impeller wheel alone. After balancing, orientation marks are placed on the impeller wheel and shaft, and the impeller is disassembled from the shaft. The turbine wheel-shaft assembly then returns to the shop for a superfinishing operation on all the shaft's journal-bearing areas. This is accomplished by mounting the turbine wheel-shaft assembly in a lathe where small abrasive stones are oscillated against the shaft while it is turning. Final surface finish in the journal-bearing areas on the shaft is from 3 to 5 microinches.

EMPLOY SHRINK-FITTING PROCESS

After superfinishing, the turbine wheel-shaft assembly, along with the oriented impeller wheel with which it was originally balanced, goes into another assembly room. Here a small oven is employed to heat the impeller again to 350°F, after which it is again press-shrunk onto the shaft in a position that complies with the orientation marks.

It should be noted that the superfinishing operation removes so little metal from the shaft (approximately .0001 to .0002 inch) that the original balance is not affected by this operation.

The next step is to install the turbocharger rotor into the center housing sub-assembly. First, a nut is torqued to 500 inch-lbs. on the impeller end of the shaft to aid the shrink fit in holding the high speed impeller on the shaft. Bearing flanges hold the rotating component in the center housing, and the nuts on these flanges are torqued to 350 inch-lbs. The bearings are of the "floating" type, floating against both the housing and the shaft. This reduces their operational speed to one-half the speed of the turbocharger, and reduces bearing wear accordingly. After this sub-assembly has been completed, end play of the turbine shaft in the center housing is checked using a mounting for the sub-assembly in conjunction with a dial gauge. End play must be held between .003 and .010 inch.

A group of turbochargers, assembled in a dust-free atmosphere at the AiResearch plant in Inglewood, California, are wheeled away to the shipping department.

The center housing sub-assembly then moves to another station where the two turbocharger end-housings are added. But before this assembly, proper clearance between the impeller and turbine wheel and the end-housing, which will cover them, must be established. This is accomplished by using a check fixture which conforms to the internal contours of each end-housing. The fixture is equipped with dial gauges. Small metal tabs on the fixture nest in bolt holes on the center housing assembly to position it correctly. Clearance between the impeller wheel and its housing must be held within .010 to .015 inch; clearance between the turbine wheel and its housing must be held to within .019 to .029 inch.

After this clearance has been established, the two end-housings are assembled to the center housing using 350 inch-lbs. torque on the bolt nuts. Dual locking tabs secure each nut. This completes the more critical portions of turbocharger assembly.

EACH OPERATION GETS DOUBLE-CHECK

During assembly, each turbocharger is accompanied by its own assembly sheet with a sequential listing of the operation to be performed. These operations are checked off and initialed by each assembly operator as he completes his respective task. Work throughout the assembly department, and especially in conjunction with the more critical operations, is divided so each operation is checked by the next man. This serves as a double-check on all assembly operations as they progress.

Final inspection of assembled turbochargers at the AiResearch Industrial Division is a critical operation indeed. This might be expected from the rugged service conditions required. During final inspection, one out of each 20 turbochargers is completely dis-assembled for thorough inspection of all component parts and the assembly techniques employed. Also, one out of each 20 turbochargers is comprehensive engine-tested by mounting it on an engine and subjecting it to service-type operation.

The value of such care in production, assembly, and final inspection is well illustrated by the progress of Garrett Corporation's AiResearch Industrial Division during the relatively few years since its organization. They are today the nation's largest producers of diesel engine turbochargers, and the company is growing rapidly. Improvements in both facilities and techniques are always in progress, and new products, including turbocharger control systems and specialized industrial valves are now being turned out. ●

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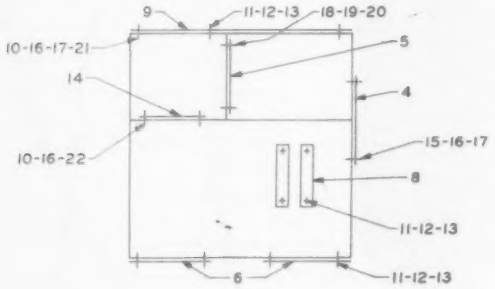
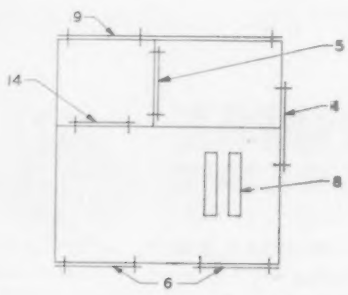
Traditional drawing (Fig. 1) itemizes hardware . . .

REQ	IT. No.	DESCRIPTION	MAT	FS	PART No.	MK	HARDWARE
	1	ASSEMBLY					
1	2	FRAME			18-000-000	001	
	3						
1	4	COVER			18-000-001	001	
1	5	BARRIER			18-000-002	001	
2	6	PLATE			18-000-003	001	
	7						
2	8	BAR			18-000-004	002	
1	9	TOP PLATE			18-000-005	001	
6	10	1/4" ROUND WASHER			Q0085753		
24	11	1/2" X 2-3/4" LG HEX HD CAP SCR		FS	Q0085469		
24	12	1/2" HEX NUT		FS	Q0085266		
24	13	1/2" LOCK WASHER		FS	Q0086499		
1	14	COVER			18-000-006	001	
4	15	1/4" X 3/4" LG HEX HD CAP SCR		FS	Q0085413		
11	16	1/4" LOCK WASHER		FS	Q0086500		
7	17	1/4" NUT-HEX		FS	Q0085262		
6	18	3/8" X 3/4" LG HEX HD CAP SCR		FS	Q0085441		
6	19	3/8" LOCK WASHER		FS	Q0086502		
6	20	3/8" ROUND WASHER		FS	Q0086560		
3	21	1/4" X 1" LG HEX HD CAP SCR		FS	Q0085415		
4	22	1/4" X 1/2" LG HEX HD CAP SCR		FS	Q0085410		



New drawing (Fig. 2) codifies hardware . . .

REQ	IT. No.	DESCRIPTION	MAT	FS	PART No.	MK	HARDWARE
	1	ASSEMBLY					
1	2	FRAME			18-000-000	001	
	3						
1	4	COVER			18-000-001	001	4BN075 (4)
1	5	BARRIER			18-000-002	001	6BW075 (6)
2	6	PLATE			18-000-003	001	IT-11-12-13 (4)
	7						
2	8	BAR			18-000-004	002	IT-11-12-13 (6)
1	9	TOP PLATE			18-000-005	001	4BN100 (3) IT-11-12-13 (4)
	10						
24	11	1/2" X 2-3/4" LG HEX HD CAP SCR		FS	Q0085469		
24	12	1/2" HEX NUT		FS	Q0085266		
24	13	1/2" LOCK WASHER		FS	Q0086499		
1	14	COVER			18-000-006	001	4BW050 (4)



Time consuming figuring of lengths and sizes of floor stock hardware by draftsmen and searching of prints by the assembliers have been done away with by a code which groups parts on the assembly drawing.

Allis-Chalmers saves time and money in the drafting room and on the assembly line by grouping floor stock fastener needs in an easily understood code.

by **Harold Fass,** Liaison Engineer
and **Ray Stowe,** Chief Draftsman
Switchgear Department
Allis-Chalmers Mfg. Co.
Milwaukee, Wisconsin

CODE FOR HARDWARE GROUPING

A new method of indicating such hardware as screws, nuts and washers on assembly drawings has definite advantages over the traditional system. Floor stocking of hardware is commonly used as a part of assembly floor procedure. Floor stock is used to reduce the required number of specification sheets as well as to reduce the number of accounting entries for the common hardware components.

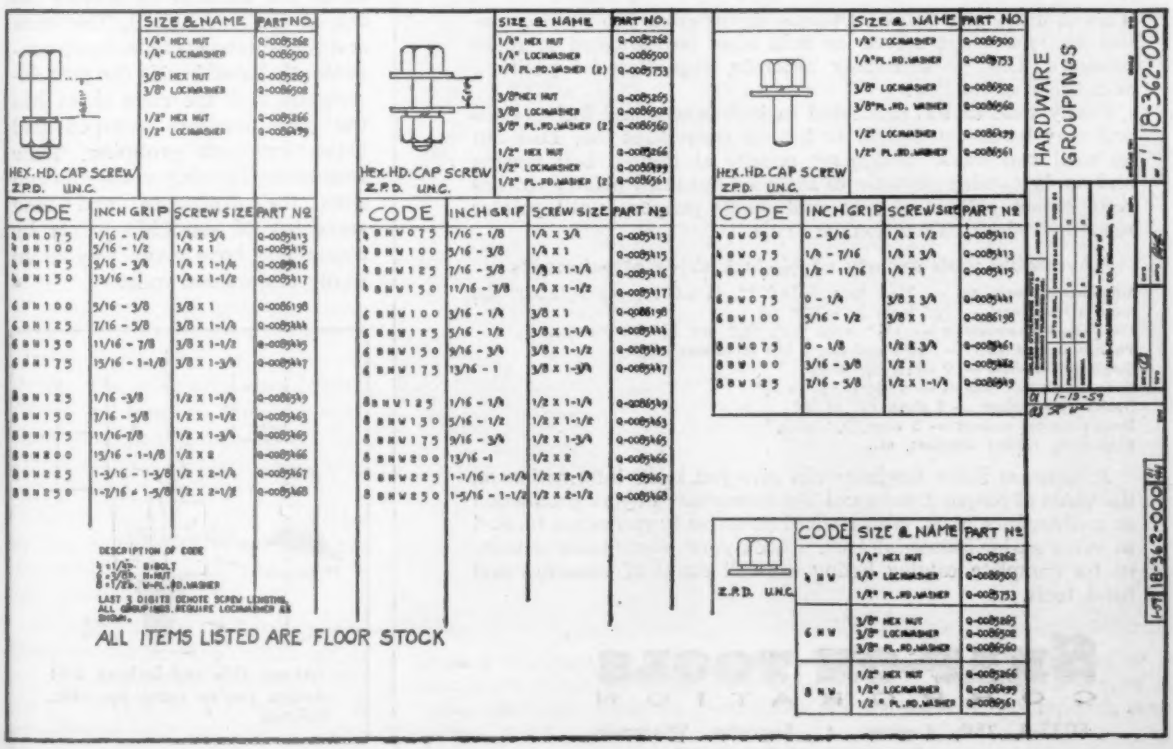
No longer is it necessary to look up descriptions and designating part numbers, and figure lengths of screws for each hardware item or add up quantities of these items and enter the required totals. The bill of material can be significantly shortened and the assembly view need not be cluttered with the usual forest of item numbers.

The drawing in Figure 2 shows the hardware column and code symbols added to the bill of material. The code, used to designate hardware, is applicable only to those items carried in floor stock and is not therefore entered on the job specification sheets. While devising the code, the various diameters of screws available were reduced to three; ¼-inch, and ½-inch diamter hex head cap screws, to standardize hole sizes. The choice of screw lengths was reduced to a minimum consistent with those most commonly used.

The hardware code in Figure 2 indicates first the screw diameter (in sixteenths of inches), "B" indicates bolt, "W" a round or cut washer, and "N" the nut. The three digits following the letters denote screw length—075 for ¾-inch length.

continued

Fig. 3. Part numbers are grouped and listed for each grouping on this code sheet.



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Available with variety of 1/4-inch drive attachments

Standard screwdrivers — 3 1/4" long: 3/16"x.032", 1/4"x.032", and 3/8"x.042" tips
Short screwdrivers — 7/8" long: 1/4"x.032" tip
Clutch-type screwdrivers — 1 3/8" long: 11/64", 13/64" and 5/32" bit diameter
Phillips screwdrivers — No. 1 and No. 2 bits in various lengths
Single hex sockets — 9 sizes, 3/16" to 1/2"
Deep single hex sockets — 9 sizes, 3/16" to 1/2"
Double hex sockets — 8 sizes, 3/16" to 1/2"
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Hardware Code, continued

The code drawing 18-362-000, shown in Figure 3, lists the grip or material thickness, the corresponding screw length and part number of that screw. Next to the illustration of the hardware is listed the necessary part numbers of the components.

The number in parenthesis in Figure 2 following the code numbers is the quantity of that hardware grouping to secure the details; the quantity shown is for one detail. Nuts and washers in the three code diameters for use on weld studs, and so on, are also shown. Lock washers are always to be included in hardware groupings.

If it is not possible to use the hardware listed on the code sheet, such items are listed as usual on the bill of material. They should, however, be indicated in the hardware column opposite the detail requiring such hardware as shown in Figure 2 for item 6 with an item number reference.

With this system of hardware grouping there is no need for the shop assembler to search the assembly print for needed hardware, nor is there any question about the number of screws required for each detail. The code and the number required are conveniently listed beside the part description and the code sheet has the part numbers grouped and listed for each grouping. Time consuming figuring of lengths and sizes for draftsmen and long searching of assembly prints by assemblers have given way to an easily understood code. •

"About this self-locking bolt design you've come up with, Frisbee . . ."

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Small assembly press and special die permit automatic, secure and uniform fastening of terminal pins to laminated plastic panels.

Dictaphone Corp., Bridgeport, Conn., fabricates for its products many small terminal boards or panels from laminated phenolic sheet in which holes have been drilled for terminal pins.

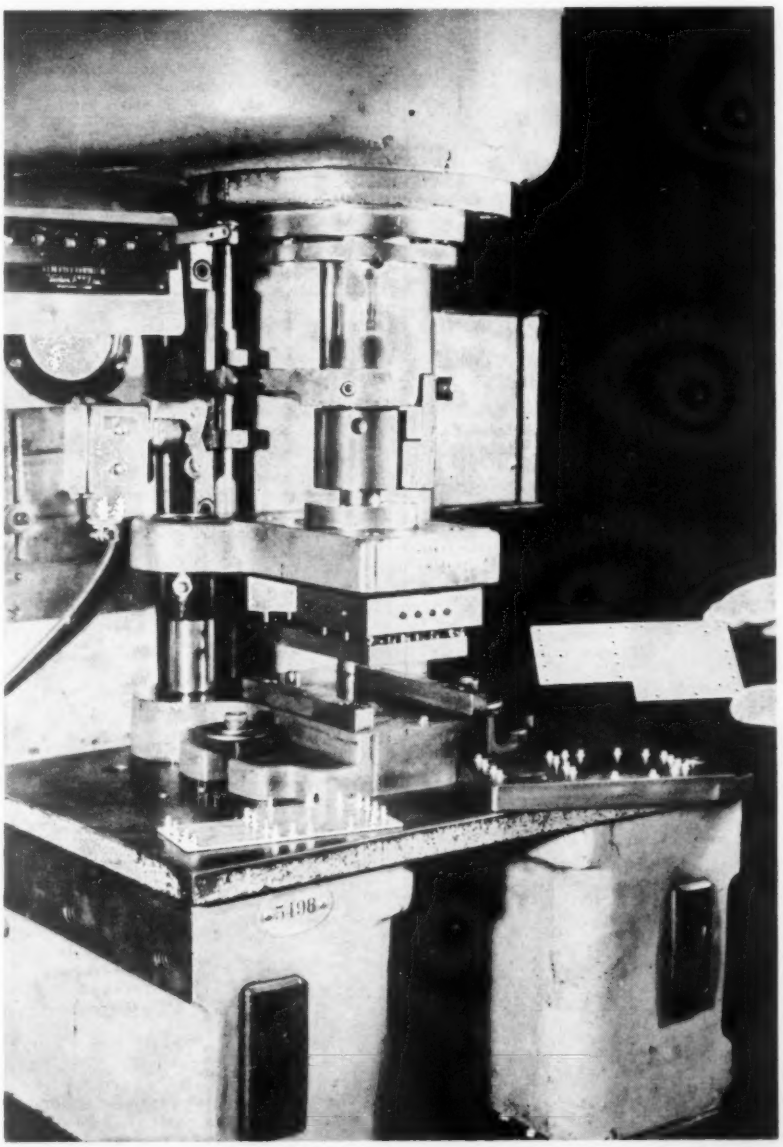
Each pin has a flange below which is a short tubular shank. When the terminal shank is inserted in a hole, the flange bears on the face of the panel. Then the shank end is expanded by a punch from the other side to fasten the shank to the panel.

Such assembly can be done one terminal at a time, but the work is being greatly speeded by using a press and special die setup. This plate or die has holes drilled in precisely the same pattern and spacing as the panel. Into each die hole a terminal pin is inserted by hand, shank up. This centers the shanks so that all will enter mating holes when the panel is laid over the die on the bed of a small Denison press.

On the press ram is a male die with one punch for each terminal. Each punch has a conical end and is centered in line with the shank axis. When the press is closed at a preset pressure, each punch strikes the corresponding hollow shank and expands its upper end. As a result, all terminals are fastened securely and uniformly with one stroke of the press.

As the operator must push one button with each hand to close the press, fingers are always in a safe position.

Since, with this hydraulic press, the pressure applied can be set at any desired level, cracking of the panel by excess pressure is avoided. •



Terminal pins once clinched by hand are now fastened in one stroke of a small press. Holes are drilled in a centering die in the same pattern as in a phenolic panel. When the press closes, the die punches and expands each terminal shank.

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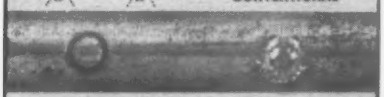

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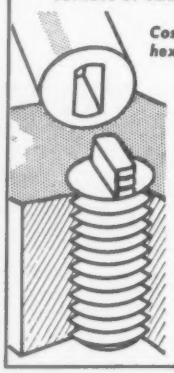

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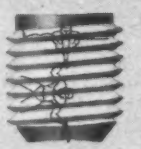

Slight variation of thread causes locking action on mating surface!

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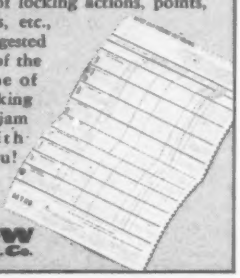

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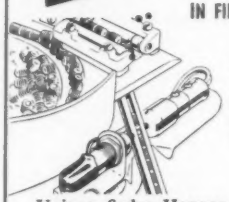

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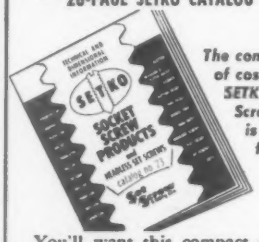
IDEA #8 THERE'S A BARREL-FULL OF IDEAS IN THE NEW 28-PAGE SETKO CATALOG #23.



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A discussion of torque-and-tension as a valuable tool when used within the permissible limits of application and control

TORQUE CONSIDERATIONS IN DESIGN

by **E. G. Wertheimer**
Manager of Operations
Sterling Bolt Company

For many years, and until just recently, the word "torque" and the related phrases "torque standards" and "torque values" were not considered wholesome. Engineers, designers, inspectors and plant operators alike were reluctant to discuss the subject. Certainly in those days they had no intention of using torque as a measurable assembly operation or even as a physical testing basis.

The reason for this reluctance was well founded. Those who tried to use it had difficulty in getting consistently uniform results on similar products. About twenty years ago, I was called to a plant to service a complaint concerning alleged bolt failure. I was referred to a department foreman, who said our ⅜" x 1½" machine bolts were no good and he offered to prove it.

He placed the bolt head in a vise and spun a heavy nut down to the end of the threaded section. Then he produced a single end wrench to which a 7' length of pipe was attached. He then proceeded to torque the nut with this equipment until failure occurred. "You see," he said, "the bolt is no good." Now in our enlightened era we don't do things that way; we only use a 6' pipe!

Seriously, however, there are still many who use torque today, who are really not adequately equipped with the necessary facilities and controls for doing the job properly.

Torque is a valuable and meaningful instrument when used within the narrow permissible limits of application and control. The variable factors and elements tending toward improper final assembly or failure in the field, must be eliminated.

One of these elements is the control, care and calibrating of torque wrenches of the mechanical type. Some pitfalls in connection with the use of such mechanical equipment include:

1. Variable air pressure when air powered wrenches are used.
2. Proper control of impact and other mechanical wrenches.
3. The assembler adjusting his own wrench.

In a well-controlled operation, no mechanic on the assembly line keeps or sets his own torque wrenches. Torque wrenches are supplied by the Inspection Department, just as are plug gauges or other inspection instruments. Wrenches are checked out to each worker at the start of a shift and checked back in when he leaves.

After being checked back in they are inspected, tested and adjusted if necessary and then retagged as being suitable for use on the next shift.

Such a system provides accurately adjusted torque wrenches for every operation, every worker and every shift. It permits rotation of wrenches among the various assembly workers.

Any discussion of tightening operations should begin by recognizing that the primary purpose is to give the bolt (by elastic elongation) sufficient internal tensile loading to enable it to withstand any external load it may be called upon to bear in service.

It has been shown repeatedly that improperly loaded bolts fail quickly from fatigue while properly loaded bolts withstand millions of external stress cycles. Torques considerably below a specified minimum may invite fatigue failure. It is for this reason that in many critical fastening operations, power tool tightening is followed by a hand check with a torque wrench preset to the minimum specification. Different tightening operations reveal a considerable variation in torque. The variation pattern differs with the type of tool, high torque operations, low torque operations and a number of other factors.

Another complication arises from friction. This may be caused by the bolt and nut being on opposite ends of the dimension tolerance range, or by the use

continued

BOLT TENSION AND TORQUE VALUES

Bolt Size (in.)	Min. Required Bolt Tension (Lb) ‡	Equivalent Torque (Lb Ft) ‡‡
½	11,500	100
⅝	17,300	180
¾	25,600	320
⅞	32,400	470
1	42,500	710
1⅛	50,800	960
1¼	64,500	1,350

‡ Equal to 90% of specified minimum Elastic Proof Load of Bolt.

‡‡ Equal to 0.0167 lb ft per in. bolt diameter per lb tension with non-lubricated bolts and nuts. The values of equivalent torque are experimental approximations. If torque rather than tension is to be measured, the torque-tension ratio shall preferably be determined by the actual conditions of the application.

APPROXIMATE TORQUE AND MINIMUM TENSILE REQUIREMENTS

Screw Size	Mach. Screws—1010 Steel Torque In. Lb.	Torque Ft. Lb.	Breaking Ld. Lbs	S.A.E. GRADE 1 Bolts & Cap Screws Torque In. Lb.	Torque Ft. Lb.	Breaking Ld. Lbs.	S.A.E. Grade 2 Bolts & Cap Screws Torque In. Lb.	Torque Ft. Lb.	Breaking Ld. Lbs.	S.A.E. GRADE 3 Bolts & Cap Screws Torque In. Lb.	Torque Ft. Lb.	Breaking Ld. Lbs.	S.A.E. GRADE 5 Bolts & Cap Screws Torque In. Lb.	Torque Ft. Lb.	Breaking Ld. Lbs.
2-56	3.0	0.3	242												
2-64	4.5	0.4	262												
3-48	5.0	0.5	322												
3-56	5.7	0.5	350												
4-36	5.7	0.5	370												
4-40	7.5	0.6	403												
4-48	8.3	0.7	437												
5-40	10.	0.8	531												
5-44	13.	1.0	552												
6-32	12.	1.0	542												
8-32	21.	1.6	790												
10-24	26.	2.2	988												
10-32	34.	2.8	1129												
12-24	43.	3.5	1228												
1/4 -20	60.	5.0	1620	67.0	5.5	1750	76.8	7.0	2200	130.	10.8	3500	130.	10.8	3800
1/4 -28	73.	6.1	1854	76.3	6.4	2000	96.8	7.9	2500	146.	12.1	4000	146.	12.1	4350
5/16-18	147.	12.1	2672	137.	11.5	2900	170.	14.2	3600	266.	22.3	5750	266.	22.3	6300
5/16-24	167.	14.0	2968	152.	12.7	3200	193.	16.1	4000	293.	24.5	6400	293.	24.5	6950
3/8 -16	229.	19.0	3952	245.	20.4	4250	305.	25.4	5350	470.	39.3	8550	470.	39.3	9300
3/8 -24	281.	23.4	4480	277.	23.0	4850	346.	28.8	6050	536.	44.6	9650	536.	44.6	10550
7/16-14	390.	32.5	5428	392.	32.6	5850	491.	41.0	7350	766.	63.8	11750	766.	63.8	12750
7/16-20				438.	36.5	6550	546.	45.4	8200	844.	70.3	13050	844.	70.3	14250
1/2 -13				598.	49.7	7800	749.	62.4	9800	1156.	96.0	15600	1156.	96.0	17050
1/2 -20				674.	56.2	8800	844.	70.3	11000	1307.	109.	17500	1307.	109.	19150
5/8 -11				1152.	96.0	12450	1410.	117.	14450	2170.	180.	22600	2388.	198.	27100
5/8 -18				1344.	112.	14100	1595.	132.	16400	2454.	204.	25600	2610.	217.	30700
3/4 -10				2118.	176.	18350	2502.	209.	19400				4092.	340.	40100
3/4 -16				2376.	198.	20500	2790.	233.	23850				4560.	380.	44750
7/8 - 9				3408.	283.	25400							6030.	502.	53150
7/8 -14				3768.	314.	28000							6690.	556.	58550
1 - 8				5112.	426.	33350							9072.	756.	69700
1 -14				5712.	476.	36450							10140	844.	76250

Based on 55 M P.S.I. Min. Tensile Str.-44M P.S.I. Min. Yield Str. Rockwell 95B (Max.) Brinell 207 (Max.)

Based On 69 M P.S.I. Min. Tensile Str.— 55 M P.S.I. Min. Yield Str. 1/2" & Smaller-64 M P.S.I. Min. Tensile Str.-52 M P.S.I. Min. Yield Str. 5/8" & 3/4"

Rockwell 100 B (Max.) Brinell 241 (Max.)

Based On 110 M P.S.I. Min. Tensile Str. 85 M P.S.I. Min. Yield Str. 1/2" & Smaller 100 M P.S.I. Min. Tensile Str. 80 M P.S.I. Min. Yield Str. 5/8"

Rockwell 95-104 B Brinell 207-269

Based On 120 M P.S.I. Min. Tensile Str.-85 M P.S.I. Min. Yield Str.-3/4 & Smaller-115 M P.S.I. Min. Tensile Str. 78 M P.S.I. Min. Yield Str.-7/8" & 1"

3/4" & Smaller- Rockwell 23-32C Brinell 241-302. 7/8" & 1" Rockwell 22-32C Brinell 235-302

Based on 84M P.S.I. Min. Tensile Str.-67 M P.S.I. Min. Yield Str. #2 Thru. #5-71M P.S.I. Min. Tensile Str.—57 M P.S.I. Min. Yield Str. #6 Thru. #10 64 M Min. Tensile Str. 52M Min. Yield Str. #12 Thru 7/16 Rockwell 100B (Max.) Brinell 241 (Max.)

Torque Considerations in Design, continued

of lock nuts, plated fasteners, plain fasteners, lubrication or non-lubrication, nicks, burrs or dirt in the threads and other factors. All of these have their own friction effect on final torque.

A designer working on truck frames calculated he needed a high strength bolt at least ½" in diameter. So he specified ⅝". On the assembly line these were being torqued to 100 ft-lbs whereas they needed at least 200 ft-lbs for proper tension. The ½" bolt at 100 ft-lbs would have given the strongest assembly at less cost.

In another case, the bucket on an earth mover was always coming loose. The design engineer kept increasing the size of the bolt to 1¼" but to no avail. The proper torque was not being applied for this size. It was suggested to return to the original ¾" bolt used, and increase the torque to 350 ft-lbs. This solved the problem. I merely quote these examples to again indicate the importance of proper tightening.

A properly tightened nut is one that applies a tension load to the bolt or stud, that is equal to or greater than the external load that is supported in service. When this condition is fulfilled and maintained against reasonably bolted assemblies, the bolt cannot fail by fatigue, because it can experience practically no change in stress regardless of the fluctuating nature of the operating load. It cannot fail statically because, to be tightened as specified, it must be capable of supporting the greatest operating load.

In applying fasteners to flexible type joints, initial tension will not prevent stress variation in the bolt. In these cases, the bolt should not be preloaded excessively since the preloading will not eliminate stress variation as it does in the rigid type joint. Excess preloading in the flexible joint will increase the bolt's susceptibility to fatigue.

Some interesting and profitable work has been done in recent years by Bethlehem Steel Company and some railroads in order to arrive at proper methods for establishing desired tension in fasteners by means of the application of torque. In order to do this job properly it becomes necessary to see that the elements which are to be joined together by fasteners are held together firmly. After this has been properly performed it becomes possible to produce the desired tension in the fastener by the so-called "turn of the nut" method. Bolts are installed with the nuts started on a thread or two by hand. The nut is then spun down tight, using an impact or other wrench, to a "snug condition."

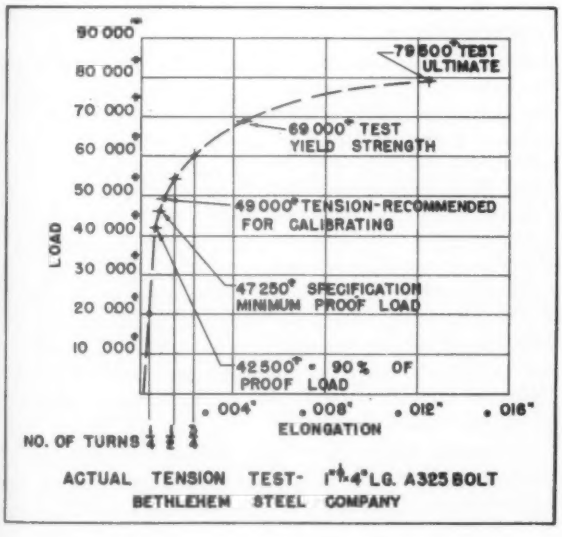
The most reliable starting point, for measuring the amount of turn, was found to be this snug condition which is achieved when the wrench starts to impact. This condition occurs when turning of the nut is resisted by the friction between the face of the nut and the surface of the steel. This "snug" position is naturally tighter than hand-tight and, therefore, less additional turning is required to bring the bolt to its proper tension. Numerous trial runs have shown that the amount of turn required from the snug position varies from one-half turn to three-quarter turn depending on bolt diameter and grip.

In the table entitled "High Strength Bolts" is indicated the various grip lengths and bolt lengths for bolt diameters ¾" through 1¼" diameter and the corresponding tensions developed in each bolt. The table was developed by trying various amounts of nut-turn and measuring the tension obtained in the bolts.

An example of how this works was reported by the Bethlehem Steel Laboratories when testing a 1" diameter by 4" long bolt. It was found that at ¼ turn, after the snug condition, a 20,000 pound load was developed in the bolt. A ½ turn developed 55,000 pounds and ¾ turn developd 60,000 pounds. This was considered as the desirable amount of turn for this bolt which showed a yield strength of 69,000 pounds and ultimate strength of 79,500 pounds.

It has been determined that under static loading, high clamping force connections have high fatigue

continued



HIGH-STRENGTH BOLTS

Bolt Diam., in.	Bolt Grip, in.	Bolt Length, in.
	Torque at least 1/2 turn	
3/4	to 5	to 6-1/2
7/8	to 5	to 6-1/2
1	to 8	to 9-1/2
1-1/8	to 8	to 10
1-1/4	to 8	to 10
	Torque at least 3/4 turn	
3/4	above 5 to 10	above 6-1/2 to 12
7/8	above 5 to 10	above 6-1/2 to 12
1	above 8 to 10	above 9-1/2 to 14
1-1/8	above 8 to 12	above 10 to 16
1-1/4	above 8 to 12	above 10 to 16

No bolt will have less than minimum specified tension.

Bolt tensions required are as follows:

Bolt Diam. in.	*Minimum Tension lb.
3/4	25,600
7/8	32,400
1	42,500
1-1/8	50,800
1-1/4	54,500

*Equal to 90 percent of minimum proof load.

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Torque Considerations in Design, continued

strength. Fatigue strength as herein referred to is actually the repeated reversal of stress.

Torque values are affected by the nature of the mating surfaces on the bolt and nut. Different and various non-realistic torque values obtained in otherwise identical fasteners result from non-uniform surface conditions from piece to piece, such as:

1. Plain smooth threads, dry.
2. Plain smooth threads, oil lubricated.
3. Plain smooth threads, moly sulphide coated.
4. Plain rough threads.
5. Scaly surfaces.
6. Plated surfaces.
7. Painted surfaces.
8. Case hardened surfaces.
9. Oxidized surfaces.

Therefore, in setting up torque standards, uniform surfaces with uniform surface treatments must be provided to obtain relative and realistic results.

Many metal-to-metal joints (if the metals have a high modulus of elasticity) can be considered as rigid joints. In such joints, external or additional loads have very little effect on the bolt stress, providing such additional loads are less than the load put in the bolt by tightening.

Generally, the purpose is to assemble a number of parts into a machine or other unit and to hold these parts together. It is not too difficult to arrive at the force required to do this. The force is not exerted by the bolt unless the bolt is properly tightened. If a selected bolt is capable of withstanding a load of 10,000 lbs. this does not mean that the bolt will apply that force to the joint unless it is tightened to that point.

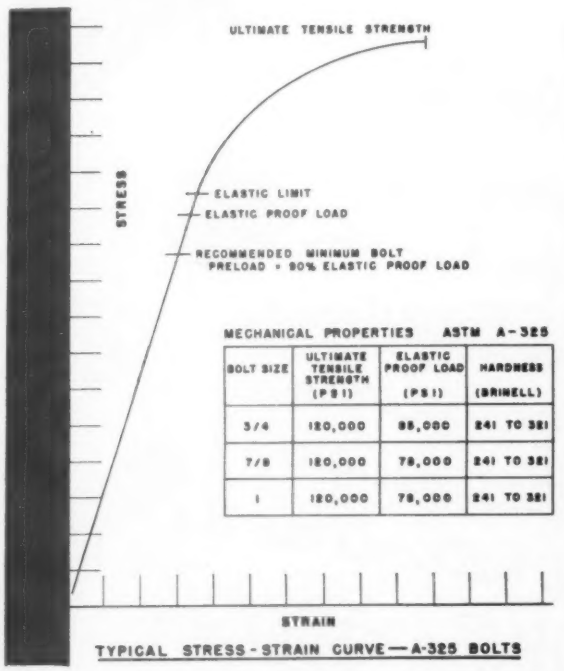
Failure of bolts in service is frequently the result of improper or insufficient tightening. Nothing is gained by selecting a strong bolt and then using none or only part of its strength. When dealing with non-rigid types of joints such as gasketed joints or joints made of low modulus materials, then external loads are partially additive to the original bolt load. In these cases it is necessary that the bolt have extra unused capacity over and above the tightening load.

There is some controversy as to the ultimate point to which a bolt may be safely tightened. Many engineers feel that the bolt should not be tightened beyond a point just under its yield strength. In determining the extent of tightening, bear in mind that steel bolts will stretch .001" per inch of stress grip length for each 30,000 psi of stress. This is not always easy to apply in practice, and a common substitute method is the use of the torque wrench. This involves performing a test by torquing a specimen bolt to its yield and then taking from 75 to 80% of this figure as the working torque. This test should be performed on several specimens and the percentage should be applied to the lowest realistic yield value obtained.

A useful bolt must have inherent qualities of ductility. To insure this condition, when testing for ultimate strength, a 10° or 6° bevelled washer, de-

pending on the fastener type, is placed under the head of the bolt. Even though subjected to this severe combination of tension and bending imposed by the wedge, the bolt must still meet its required ultimate strength without breaking.

A popular bolt in the structural erection field is known as the "high strength structural bolt." It is similar to SAE grade 5. The recommended preload of this bolt is 90% of the proof load minimum. The actual bolt tension may be higher, in fact there is no known plastic yield for this particular quality except ultimate breakage. Many engineers have the idea that bolts stressed beyond their yield point immediately become plastic and lose all of their load carrying capacity. This is not true of this grade; the stress strain curve is a straight true modulus line up to the elastic limit. It then curves off gradually without any sudden or clearly defined yield point, to an ultimate strength that is 70% greater than the minimum preload requirement. Because there is not a sudden yield point and because there is 70% reserve strength, there is plenty of additional capacity.



MECHANICAL PROPERTIES ASTM A-325

BOLT SIZE	ULTIMATE TENSILE STRENGTH (PSI)	ELASTIC PROOF LOAD (PSI)	HARDNESS (BRINELL)
3/4	120,000	85,000	241 TO 321
7/8	120,000	78,000	241 TO 321
1	120,000	78,000	241 TO 321

TYPICAL STRESS-STRAIN CURVE—A-325 BOLTS

Many engineers believe that bolts in this grade, stressed beyond their yield point, will perform equally as well where high clamping forces exist on rigid joints, as with bolts carrying only the recommended preload. They will carry just as much load whether statically or in fatigue, and the bolts themselves are not weakened due to over-tightening. This has been satisfactorily demonstrated many times and leads to the conclusion on the part of some engineers that given the proper fastener such as an SAE grade 5 bolt, it may be stressed to points beyond yield strength. •

This article is based on an address by the author before a symposium on "Industrial Fastener Applications" at the University of Wisconsin, November 19-20.

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THE EVOLUTION OF A FASTENING IDEA

by **Matt E. Heuertz**
Managing Editor

How do new types of fastening devices come about? Just where do the ideas come from?

A classic example from the human interest angle is one which evolved out of a tragedy. It led to the founding of the Klincher Locknut Corporation. This story begins at the first Indianapolis 500-Mile Race back in 1911.

Eleven-year old Eddie Pummill witnessed this first "classic" and got the racing bug. He did a lot of racing during his teens, but quit the track in 1922 to found the Indiana Carburetor and Brake Company.

The nature of his business kept him in the center of the Indianapolis "500", and by 1937 he was a member of the A.A.A. technical committee.

This was the year that he watched car No. 66, driven by Overton Phillips with Walter King as the riding mechanic, veer off the straight-away into the pits. It struck another car being worked on by O. C. Rohde, chief engineer of Champion Spark Plug Company, and Tony Caccia, a mechanic. A sheet of flames engulfed both cars and snuffed out Rohde's life. George Warford, another mechanic, was struck by flying parts and died from injuries.

Eddie Pummill made an immediate investigation, and the blame was placed on a broken connecting rod bolt. "When the bolt failed," says Eddie, "the connecting rod tore through the crankcase, breaking the gas line, setting the car on fire, and causing the fatal accident.

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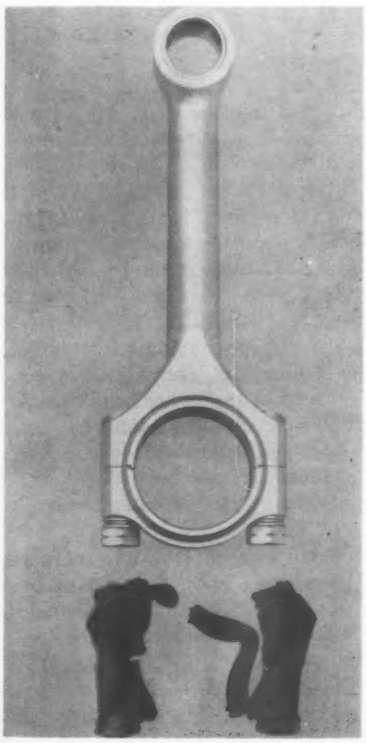

A new connecting rod for a racer is shown here with the broken parts of what was left of a rod that had a lubrication failure. The nut and bolt assembly was the only part of this rod that did not fail.

In photo taken prior to 1959 Indianapolis 500 Mile race, Louis Meyer, 3-time winner, and E. W. Pummill, president of a fastener firm, study connecting rod bolt used in Meyer-Drake engines. Locknut invented by Mr. Pummill is used on all rod bolts in the engines. At right is Ray Drake.

SPIROL — the spring pin with Wider Hole Tolerances

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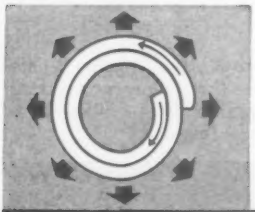

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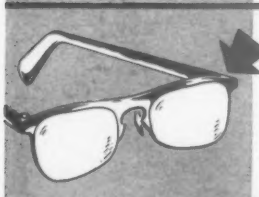

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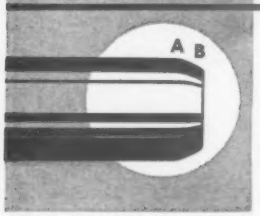
SPIROL is the only spring type pin available in these miniature diameters: 1/32" — .039" — 3/64" — .052". Unique spiral cross-section retains flexibility and strength in smallest sizes. Other standard sizes up to 1/2" diameter.



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Further investigation revealed that connecting rod failures were responsible for a good many racing car accidents. Conventional nuts and bolts just couldn't be depended upon to hold up under the stress and strain of a 500-Mile Race. The reason is understandable. All the kinetic energy of a 2000-lb car is carried in the connecting rod bolts when the car is rapidly decelerated from around 180 mph on the straight-away to about 120 mph on curves.

Actually, the connecting rod serves to "brake" the car when the gas flow is cut off for deceleration. And decelerating four times on each 2.5 mile lap means that the connecting rod must brake the entire load of the car 800 times during a 500-mile race. That's a lot of punishment.

After pondering this problem, Eddie Pummill decided to do something about it. He had noticed that it was the first two or three threads on the nut and bolt that gave away first. So for the next ten years he sought just one thing—a means of distributing the straining forces equally among all the threads, and thus reduce thread distortion and bolt failure.

Finally, he came up with a self-energizing locknut. Made of 18-8 stainless steel, it is capable of withstanding 1600°F. without failure.

Locking of the nut is accomplished by deflection of metal when the nut is wrenched down against the work surface. After it is tightened, the clamping forces are distributed uniformly to all the threads. The nut will remain locked in this position until it is released by a wrench. Then it becomes free-running and can be spun off with the fingers. It can be reused hundreds of times without injury to the thread or bolt.

The nut received its first test in 1947 when the great Wilbur Shaw, later President of the Indianapolis Motor Speedway, and three-time winner of the "500" had a racer built to his specifications which included Eddie Pummill's new locknut. Not one nut came loose after 500 miles.

The first car to win a "500", using Klincher locknuts was the one piloted by Johnnie Parsons in 1951. Today these nuts are considered standard equipment on practically all championship American-built racers. And since the widespread use of this nut on racers, there has not been one case of a rod-bolt failure due to stress concentration and torsional load.

The locknut received one of its most severe tests at a race in Milwaukee in 1958. A rod-bolt broke on Johnny Thomson's car. Though the connecting rod was bent out of shape, the nut on the end of the rod hadn't budged.

But applications on race car engines were only the start. The major applications today are on jet aircraft and missiles where high heat and high frequency vibrations are encountered. For instance, these nuts are specified in turboprop engines subjected to 1,800,000 vibrations a minute. And when used on thermocouples they have been found to last indefinitely at 1600°F. •

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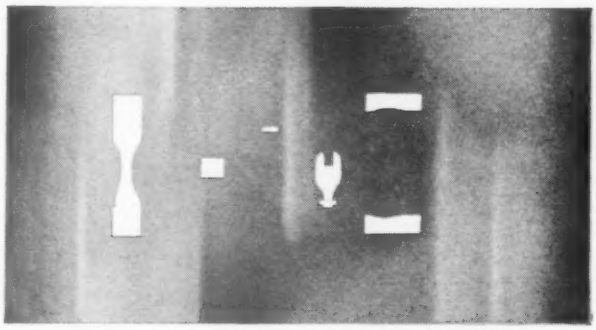
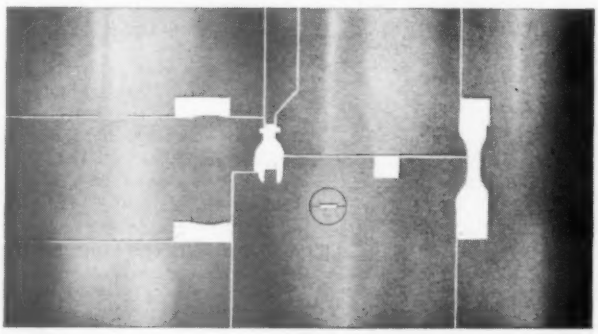


Now this solid die plate



replaces the 9-section die plate formerly required

TO PRODUCE THIS PART

With Elox* Electrical Discharge Machining it was done fast, economically, to exact tolerances . . . 33% SAVINGS ON THE COMPLETE DIE.

Can you afford to use yesterday's expensive machining methods when your competitors are realizing tremendous savings with EDM?

Impossible yesterday . . .
standard with
ELOX* EDM today!

CONTACT YOUR ELOX AREA ENGINEER FOR COMPLETE INFORMATION

*Reg. T. M.

elox
corporation of michigan

1830-B Stephenson Highway
Troy, Michigan

Use postpaid card. Circle No. 229

heat treated
alloy steel nuts
selected and tapped
face down
within .002"
face run-out
Such accuracy is easily held on Snow machines. They show up best on hard-to-hold, tough steel parts where accuracy and quick changeover are important. They cut production costs, help you to make reliable deliveries of high quality parts. Snow has 3 types of machines for tapping (see below). On your next job let us show you what the Snow method can do. We invite samples and prints.

SNOW NUT TAPPER (like above). Hopper can select flanged nuts FACE DOWN.

SNOW HORIZONTAL MACHINE For special parts that need clamping. Hopper or hand feed.

SNOW VERTICAL MACHINE For short runs on a quickly changed dial index plate.

Snow Manufacturing Co., Dept. C, 435 Eastern Avenue, Bellwood, Illinois. Telephone, Chicago, ESterbrook 8-7142

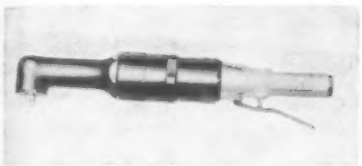
master [illegible] tooling costs

SNOW

Use postpaid card. Circle No. 230

WHAT'S NEW IN EQUIPMENT

For information on any equipment listed here, use the postpaid card opposite page 66. Just circle the number on the card matching the number following the description. We'll do the rest.



(See 1)

90° AIR NUTRUNNER FOR TIGHT SPOTS

Heavy-duty right angle wrenches are designed for power nutrunning in difficult access areas.

The non-reversible 90° angle wrenches are of the stall-type with a ½" square drive spindle. Three models with speeds of 1000, 700 and 500 rpm have rated bolt size ranges from 7/16" to 9/16". Torque outputs are from 30 to 63 ft.-lbs. Recommended working air pressure is 90 to 100 psi through ⅜" I.D. hose.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio.

Use postpaid card. Circle No. 1

(See 3)

SLIDE-RULE INSTRUMENT ESTIMATES ASSEMBLY TIME

A slide-rule type instrument will automatically estimate the assembly time of electronic and electro-mechanical assemblies.

The calculator can be used for estimating, scheduling, evaluating performances and setting objectives. Basic data fed into the unit is the type and number of operation comprising the complete assembly. $15.

Manufacturing Laboratories, 507 Fifth Ave., New York 17, N.Y.

Use postpaid card. Circle No. 2

(See 4)

SOLDERING UNIT REPAIRS PRINTED WIRING BOARDS

An induction de-solder and solder device for repair and salvage of printed wiring assemblies is said to result in man-hour savings of up to 20% over conventional methods.

Entire units on large, previously irreparable, multi-terminal assemblies can be removed without damage to the assembly board or to other components.

This device is effective for repairing: single sided PWA's—without metal (plating or eyelet) in the holes; single- or double-sided PWA's of either the plated-through or eyelet types, in 1/16 to 1/8 inch minimum range of board thicknesses.

Operated manually or automatically, the semi-portable device has a heat-extract sequence for de-soldering operation, and a heat cycle for soldering.

General Electric Co., Schenectady 5, New York.

Use postpaid card. Circle No. 3

DIMPLING RIVETER FOR HIGH TEMPERATURE ALLOYS

Depending on fastener type and size, capacity of a 24" throat dimpling machine ranges to .125". Designed for high temperature alloys, it will also handle the softer alloys, including vanadium and manganese alloys of titanium.

The Model C-125 Airflex Control can spin-impact pierce through .150", spin-impact rivets through ⅜" mild steel, and squeeze rivet and pierce with 13-tons pressure. High frequency impacts, plus spinning, reform delicate metal structures by minute radial stages without shearing. Work cycle is automatic.

Lemert Engineering Co., 1313 Western Ave., Plymouth, Indiana.

Use postpaid card. Circle No. 4

UNIT SPEEDS INSPECTION OF BRAZED HONEYCOMB JOINTS

Inspecting of brazed honeycomb joints can be done by a photo-fluorography technique that gives required 3% sensitivity and covers 145 sq. ft. per hour on a 4" panel thickness.

In operation, the x-ray head and detector move across the structure, exposing 16" x 16" sections. Each of these projections on the fluoroscopic screen is recorded by the camera and ready for inspection "within minutes."

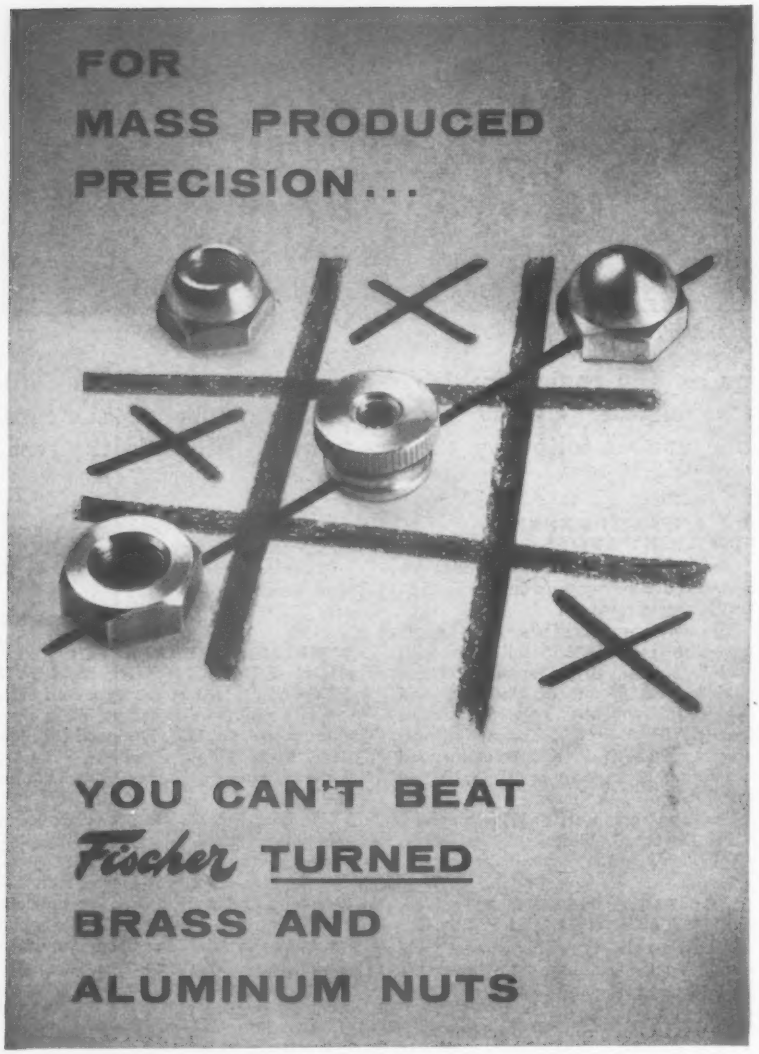
Picker X-Ray Corp., 25 S. Broadway, White Plains, New York.

Use postpaid card. Circle No. 5

COPPER CYANIDE PROCESS OFFERS BRIGHT DEPOSITS

A new bright copper cyanide process offers smooth, bright deposits over a wide temperature and current density range; good metal distribution; solution simple to operate and control. Deposits can be buffed.

Copper-Lume bath constituents can include either potassium salts, a mixture of potassium and sodium salt or sodium cyanide only.



In the game of tick-tack-toe, the right *second move* is very important. It can pre-determine the winner.

The same principle applies in purchasing precision nuts. *First:* decide the type and size of nut required. *Second:* specify the recognized source for quality, delivery and price . . . Fischer Special Mfg. Co.

As the leading producer of "turned" nuts, Fischer supplies standard, special and miniature nuts to exact customer specifications. Fischer nuts, mass produced by unique automatic machines, cost no more than those made by less precise methods . . . but their uniform accuracy assures fewer problems and new savings in fastening and assembly operations. *That makes you the winner!*

FOR DETAILS AND SPECIFICATIONS
SEND FOR CATALOG FS-1000.

there's no premium for precision at

Fischer SPECIAL MFG. CO.

496 MORGAN STREET • CINCINNATI 6, OHIO

Use postpaid card. Circle No. 231

Hanson-Van Winkle-Munning Co., Church St., Matawan, N.J.

Use postpaid card. Circle No. 6

IMPROVED RIGID FRAME DIAL-TYPE TORQUE TOOL

With ⅜" of rotary travel left or right, a rigid frame dial indicator type torque tool exerts a full 30 in.-lbs. of torque.

The RDI-30 weighs 7 ozs. and is 8" long. Graduations are balanced 30-0-30 in.-lbs. with minimum gradation equal to 1 in.-lbs. A ¼" square drive with a snap ball lock fits all standard sockets.

A snap button on the back of the frame enables calibration check and resetting.

Apco Mossberg Co., 100 Lamb St., Attleboro, Massachusetts.

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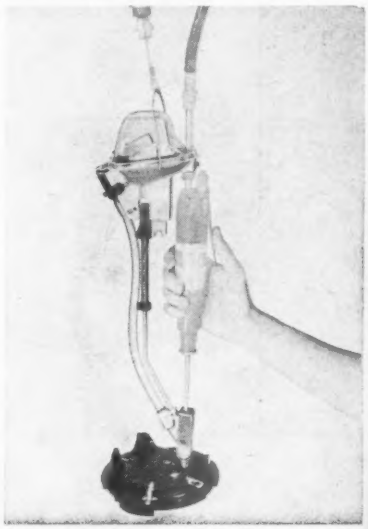
AUTOMATIC FEEDER FOR VERTICAL SCREW DRIVING



An automatic screw feeder can be used with all makes of pneumatic and electrical tools to feed and position all types of screws.

Designed for vertical screw driving, the Strippit Zipp Screw Feeder consists of a hopper holding the screws and an elevator which picks up the screws and feeds them, one at a time, through a plastic tube by gravity with each driving stroke of the tool. As the screw is set under the driving blade, a collet which is precision machined holds the screw accurately and firmly in place. The outside of the collet is specially shaped to find the screw holes and can be modified for use in the closest quarters even where applications require screw heads to touch each other.

Wales-Strippit, Inc., 241 Buell Road, Akron, New York.

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"ROCKFORD" HOME WORKSHOP

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ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

Hobby-neering with "ROCKFORD" Screw Products

"ROCKFORD"®
HOME WORKSHOP PROJECT of the MONTH

Suet Feeder

Hobby-neering with "ROCKFORD" Screw Products
ROCKFORD ILLINOIS

ORIGINAL DESIGNS

JANUARY 1960

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HOME WORKSHOP

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ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

Hobby-neering with "ROCKFORD" Screw Products

ROCKFORD® HOME WORKSHOP PROJECT of the MONTH

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ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

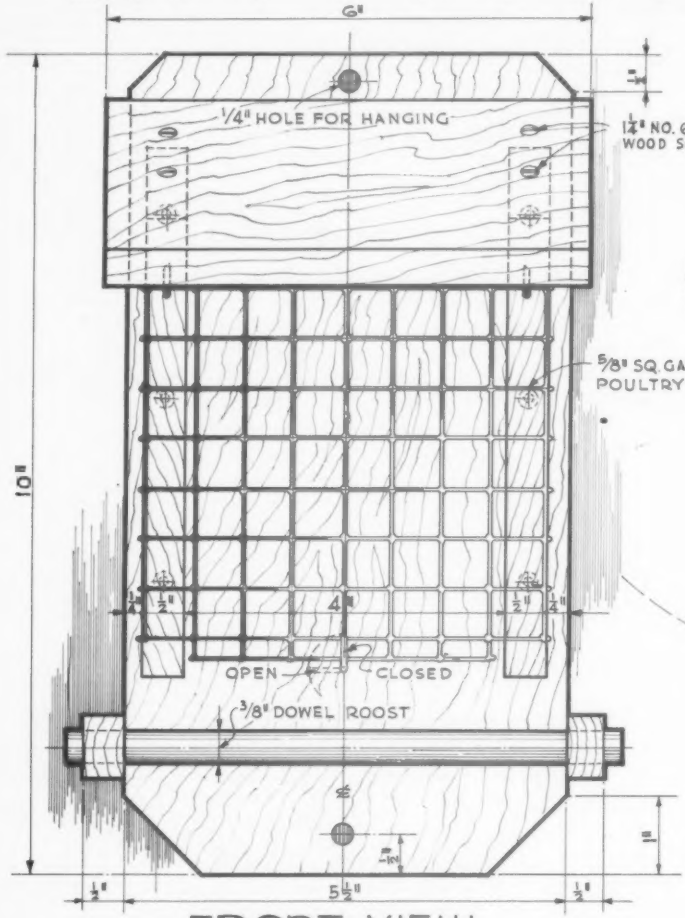
Hobby-nering with ROCKFORD Screw Products

"ROCKFORD" HOME WORKSHOP PROJECT of the MONTH

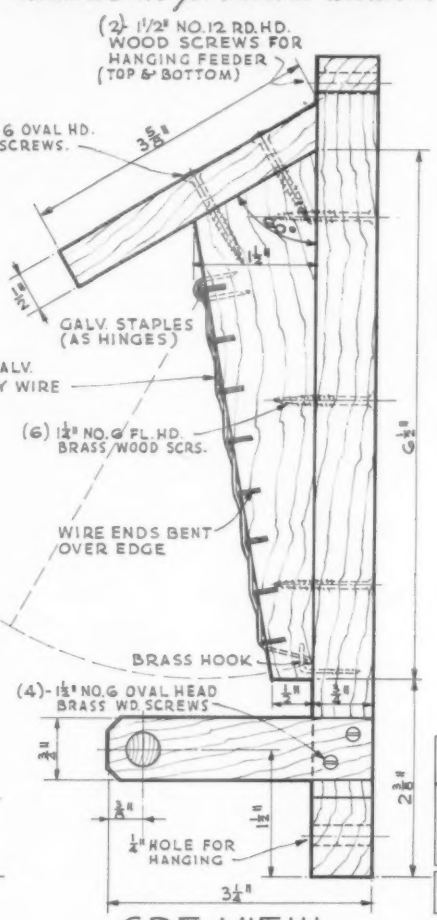
Bird: Suet..Feeder

"Help Protect our Native Song Birds by Providing Food and Shelter on Your Home Grounds"

SCALE: INCHES 0 1 2 3 4 5 6



FRONT..VIEW


(2) 1 1/2" NO. 12 RD. HD. WOOD SCREWS FOR HANGING FEEDER (TOP & BOTTOM)
3 5/8"
GALV. STAPLES (AS HINGES)
1 1/2"
(6) 1 1/2" NO. 6 FL. HD. BRASS WOOD SCRS.
WIRE ENDS BENT OVER EDGE
BRASS HOOK
(4)-1 1/2" NO. 6 OVAL HEAD BRASS WD. SCREWS
3/4"
1 1/2"
1/4" HOLE FOR HANGING
3 1/4"
2 3/8"

SIDE VIEW

6-11-81

HAGER DESIGN STUDIO, R

BIRD..SANCTUARY

● We ARE AGAIN HEARING OF THE GREAT DEVASTATION OF CROPS & VEGETATION CAUSED BY HORDES OF CATERPILLARS AND OTHER DESTRUCTIVE INSECT PESTS WHICHIS INCREASING IN SPITE OF CHEMICAL WARFARE WAGED AGAINST THEM. LET OUR INSECT EATING BIRDS TACKLE INVADERS BY PROVIDING PROTECTION & HOUSING FOR THEM.

● OUR VALUABLE NATIVE SONG BIRDS ARE UNPREPARED FOR LACK OF HOUSING AND OUR NEGLECT TO PROVIDE IT. REMOVAL OF HEDGEROWS & OLD TREES FROM OUR HIGHWAYS & BYWAYS IS DESTROYING MUCH OF THE NATURAL HABITAT OF OUR FEATHERED FRIENDS. POISONOUS LARGE SCALE CROP SPRAYING HAS ALSO TAKEN HEAVY TOLL... SO LET US WHO OWN PROPERTY.. BEGIN TO MAKE PLANS TO ENCOURAGE THE VALUABLE INTERESTING BIRDS TO OUR OWN BIRD SANCTUARIES ON OUR HOME GROUNDS.

● PROVIDE BIRD HOUSES DESIGNED AND BUILT TO MEET SPECIFIC REQUIREMENTS OF NATURAL NESTING CONDITIONS... PROVIDE FEEDERS TO ATTRACT THEM... PLANT ORNAMENTAL SHRUBS BEARING BERRIES & SEEDS FOR WINTER FOOD & PROTECTION.

● ELIMINATE THE UNDESIRABLES: SPARROWS, STARLINGS, BLACKBIRDS & CROWS. CATS ALSO. (PLEASE DO NOT BE TO SENTIMENTAL ABOUT THIS)

HOPE YOU LIKE THIS PROJECT. Henry.

• BILL OF MATERIALS •

1 PC.	3/4" x 5 1/2" x 10"	Back	
1 "	1/2" x 3 5/8" x 6"	Roof	Pine or
2 Pcs.	1/2" x 1 1/2" x 6 1/2"	Sides	Cedar
2 "	1/2" x 3/4" x 3 1/4"	Brackets	(Painted
1 Pc.	5/8" x 7"	Dowel	or Stained)
1 "	6" x 6" x 1/8"	Mesh	

ROCKFORD" LITY CONTROLLED OOD SCREWS
" NO.6 FL. HD.
" NO.6 OVAL HD.
" NO.6 " "
" NO.12 RD. HD.
ALV. STAPLES
RASS HOOK.
SCREWS (BRASS) TEEL. CAD. PLATED
DIO, ROCKFORD, ILL.

Hobby-rearing®

SERIES.. NO.9

PROJECT 11

USE FOR COMMERCIAL PURPOSES IS STRICTLY FORBIDDEN

Designed by A. Hager OF ROCKFORD

★ HERE THERE AND EVERYWHERE with "ROCKFORD" Screws and Bolts ★

CHROMCRAFT INTRODUCES TRADE WIND — T967/C556

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CHROMCRAFT CORPORATION
4321 Semple Ave.
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Manufactured by:
MERRY MANUFACTURING CO.
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EDMONDS, WASH.

2½ H.P. ENGINE
FRONT MOUNT
ATTACHMENTS
SICKLE MOWER
BURDEN CARRIER
WATER PUMP
LAWNAERATOR
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★ QUALITY CONTROLLED "ROCKFORD" PRODUCTS ★

AIRCRAFT

★ SCREWS ★ BOLTS ★ PINS ★

"ROCKFORD"®
Screw Products Co.

ROCKFORD · ILLINOIS

Send for complete catalog and prices on "ROCKFORD" Screw Products

DO YOU KNOW?

Many people are surprised to learn of the many different services Rockford Screw Products offers its customers. Service is our business, and it is our constant aim to help you with any or all *fastener* problems that may arise in your assemblies. Send us your ideas, blueprints or samples; perhaps we can make your parts better, faster, and cheaper by our advanced method of Cold Forging from wire.

Hobby-nearing with "ROCKFORD"
ROCKFORD Screw Products ILLINOIS

ORIGINAL DESIGN

JANUARY 19

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TELETYPE
R.K. 7603

"ROCKFORD"®
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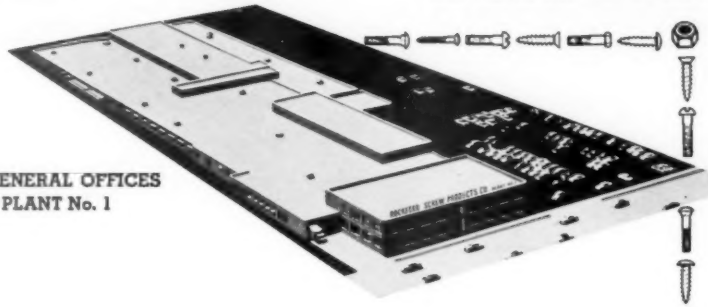
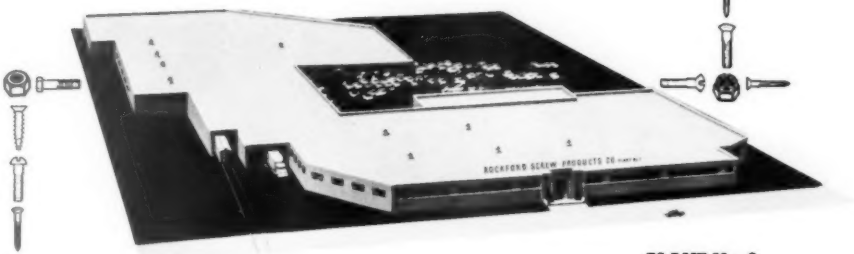
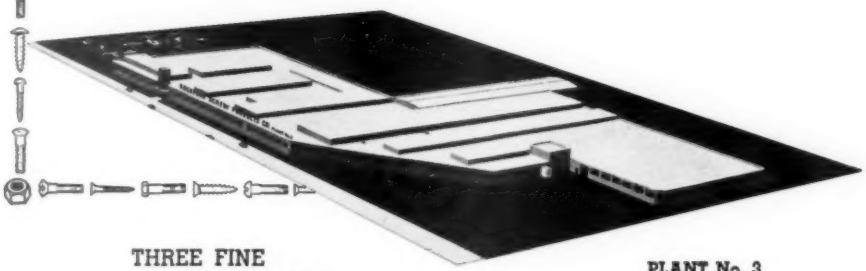


GENERAL OFFICES
& PLANT No. 1



PLANT No. 2



PLANT No. 3

THREE FINE
MODERN PLANTS
PRODUCING "ROCKFORD" QUALITY CONTROLLED
THREADED FASTENERS FOR AMERICAN INDUSTRIES.

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ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

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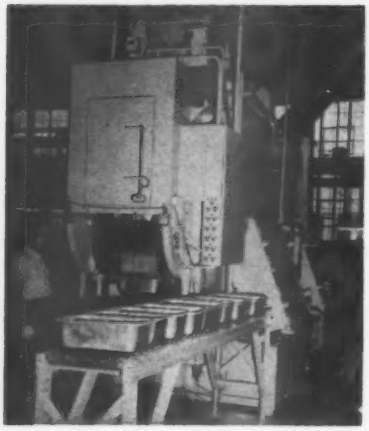
HOME WORKSHOP
PROJECT of the
MONTH

PARTS REMAIN IN TOTE BOXES DURING WASHING



An automatic small parts washing machine permits parts to be cleaned while remaining in, and inseparable from, tote boxes from start to finish.

Tote boxes containing work are locked to the machine's special mesh drums and pass together through washing, rinsing and drying cycles.

The Model DJ washer's rotational action can be adjusted for variable high and low speed tumbling.

Industrial Systems Co., 31 Main St., Matawan, New Jersey.

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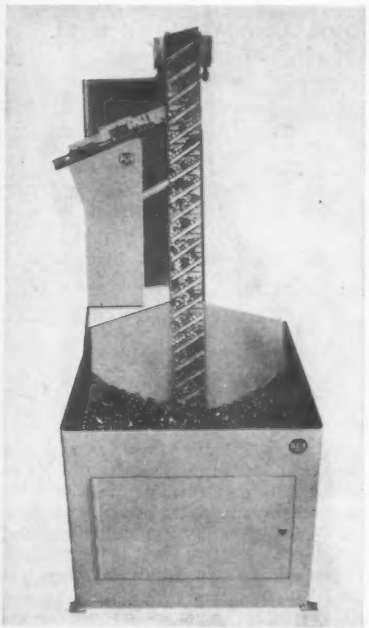
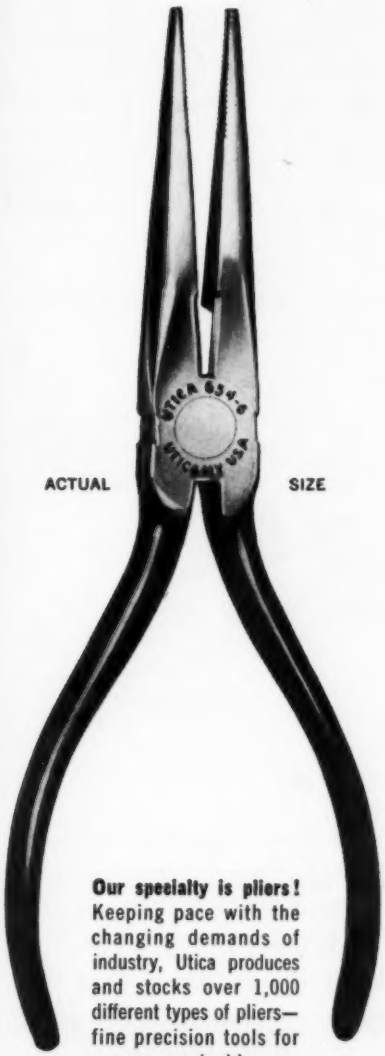
BELT ELEVATOR FEEDS, ORIENTS PARTS



An orienting belt elevator handles rolling or sliding parts. It has variable speed drive and can be equipped with "demand-feed" controls.

Storage capacity of the hopper is 15 cu. ft. and the unit can be used to feed rotary and vibratory hoppers or

UTICA



Our specialty is pliers! Keeping pace with the changing demands of industry, Utica produces and stocks over 1,000 different types of pliers—fine precision tools for every conceivable use. Because of the job we have been able to do in many of the country's largest and most specialized plants, we believe that Utica tools can help you, too—either reduce your costs or improve your products. Contact your Utica distributor, today.

Utica Drop Forge & Tool Division, Kelsey-Hayes Company, Utica 4, N. Y.

tools the experts use!

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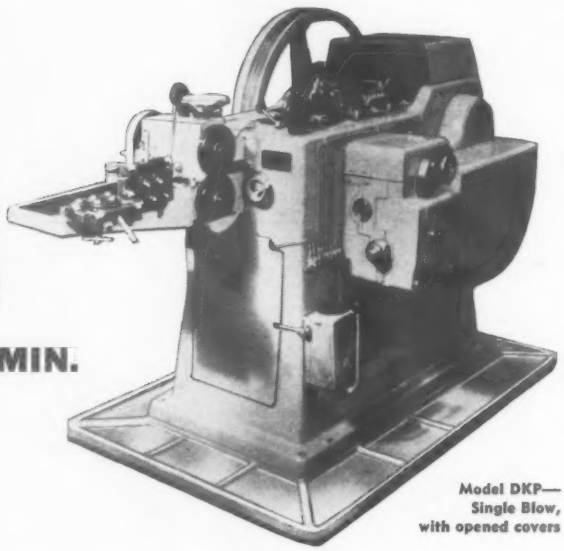
Single and Double Blow

COLD HEADERS

UP TO 350 PCS. PER MIN.



Model DKP—Single Blow, with opened covers

These famous German machines feature:

- ★ CAPACITIES—3/16" to 1" dia. wire stock: Short Stroke—1" to 4-15/16" shaft length; Long Stroke—1 ¾" to 8"
- ★ Fitted with solid or open dies
- ★ QUICKLY ADJUSTABLE PUNCH SHIFTING SLIDE—has double locking mechanism
- ★ WEAR PLATES ARE ADJUSTABLE nitraded steel
- ★ ONE SHOT LUBRICATING SYSTEM—to all parts of machine
- ★ Special types of Cold Headers for the production of balls, cylindrical and taper rollers and cold forged components
- ★ A complete range of auxiliary equipment such as re-heading machines, trimmers, pointers, slotters and thread rollers are available

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feed parts directly into production or assembly machines.

Radio Corporation of America, 12605 Arnold Ave., Detroit 39, Mich.

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NLYON-LIKE AIR HOSE IS SELF-STORING

A polyamide self-storing air hose eliminates hose reels and cumbersome storage facilities when used with portable air tools and hoists.

It offers lightness, resistance to kinking and ability to absorb twist. The hose is supplied coiled with reusable fittings and a spring guard to prevent crimping.

The micro-finished bore, combined with full-flow, non-flared fittings, assures unobstructed air flow for pressures to 200 psi. Maximum working length is approximately 20 ft. while coiled length is under 1 ft.

Synflex Products Division, Samuel Moore & Company, Mantua, Ohio.

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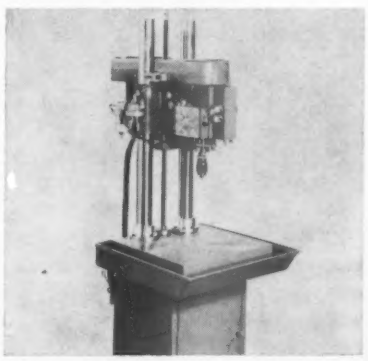
DRILLING MACHINE WILL ALSO TAP, THREAD



A single spindle vertical machine is designed for drilling, tapping, countersinking, facing, reaming, hollow milling or threading. Its capacity is from .020" to ⅜" drilling in mild steel and up to ⅜" tapping and ½" threading.

Normal speed ranges between 500 and 10,000 rpm. Maximum stroke length is 2½". Up to 500 strokes per minute are possible. Minimum distance from spindle nose to table work surface is 0"—maximum is 24". Clearance between center line of spindles and columns is 8½".

Universal-Automatic Corp., 9545 Ainslie St., Schiller Park, Ill.

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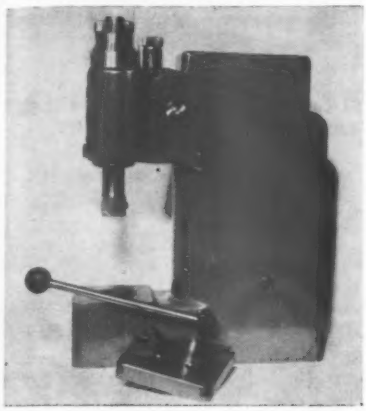
PNEUMATIC PRESS HAS REMOVABLE GROUND BASE



An air press has a hand scraped base with a bore through the center. This allows the pressing of parts onto long shafts which now can protrude below the machine.

An auxiliary ground T-slot base is provided as an accurate means of setting up temporary tooling.

The PH 2 micrometer depth control is accurate to .0001". Variable speed control is independent of pressure setting and length of stroke is adjustable from .001" to 1.18".

American Lip Corp., 610 Fifth Ave., New York 20, New York.

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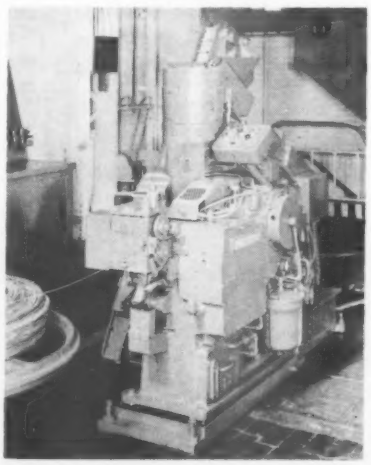
ENTIRE FASTENER-MAKING IN ONE COLD HEADER



The separate operations of fastener-making—cold-heading, pointing and thread-rolling—are incorporated in one unit.

The Single-Die Boltmaker is available in several specifications, ⅛" (pictured), 3/16" long stroke and 5/16". Production of finished pieces per minute is 400, 200 and 175 respectively.

One operator controls the entire process, which features a single-heading die, solid cutter (standard stroke), two-blow heading tools, blank elevator and

Men who know and specify special fasteners depend on this familar symbol . . . ⟨CP⟩ . . . the famous Chandler hallmark for precision and reliability in fasteners. It's your guarantee that each fastener meets the rigorous materials and performance tests required by industrial and military standards. Before placing your next order . . .

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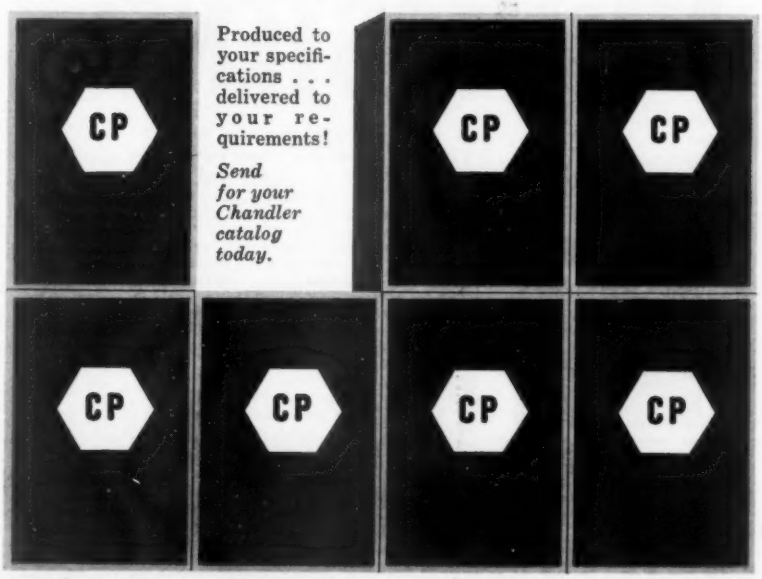

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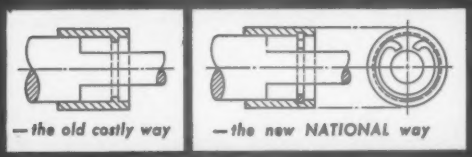
SAVE ON MATERIALS . . .

NATIONAL
RETAINING RINGS

– improve products and cut costs substantially!

SAVE ON LABOR

Efficient and economical NATIONAL Retaining Rings reduce weight, save space, simplify assembly and reduce production operations. Elimination of machining to form shoulders, threading, nuts and cotter pins are typical savings that can be effected. Ask NATIONAL for complete information and data on your particular applications, now!



— the old costly way — the new NATIONAL way

FREE SAMPLES
And descriptive literature will be sent promptly on request. Call or write to National, today.

The NATIONAL LOCK WASHER COMPANY
Serving Industry Since 1886
NEWARK 5, NEW JERSEY • MILWAUKEE 2, WISCONSIN

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☐ REDUCE COSTS
☐ SIMPLIFY ASSEMBLY
☐ IMPROVE APPEARANCE with

DIE CAST ZINC ALLOY & MOLDED NYLON

GRC FASTENERS

DIE CAST ZINC ALLOY
Wing Nuts
Cap Nuts
Thumb Nuts

now . . .
NYLON NUTS
added to GRC's extensive line of
NYLON SCREWS

Brand New! Nylon hex nuts in ten sizes: #2 thru 5/16" . . . Complementing GRC's Nylon Screw line. Nuts are single chamfered, washer-faced, double counter-sunk. All available from stock . . . Samples sent immediately.

• Uniformly accurate • High in quality Low in cost
• Wide range of stock styles, types, sizes and threads

Produced in one high speed automatic operation, GRC's exclusive methods assure uniformity, smooth, rustproof & corrosion resistant surfaces and the lowest possible cost. New kinds of fasteners never before available . . . modifications in stock fasteners for specialized use . . . infinite variety in styles, types and sizes, have been made possible by GRC's special automatic die casting and molding machines.

Write, wire, phone RIGHT NOW for prices, your copy of GRC's NEW DETAILED INDUSTRIAL FASTENER CATALOG

Thumb & Wing Screws

MOLDED NYLON
Screws
Hex Nuts
Washers
Screw Insulators

World's Foremost Producer of Small Die Castings

GRIES

GRIES REPRODUCER CORP.
15 Second St., New Rochelle, N.Y., NEw Rochelle 3-8600

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orienter, pointing by extrusion and a thread rolling station.

The National Machinery Co., Tiffin, Ohio.

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SIX SIZES ADDED TO LINE OF RATCHET BOX WRENCHES

Six sizes of ratcheting box wrenches with six and 12 point openings from ¼" to ⅞" have been added to a hand tool line. Critical parts are heat-treated. Wrenches are chrome-plated over nickel and made of alloy steel.

J. H. Williams & Co., 400 Vulcan St., Buffalo 7, New York.

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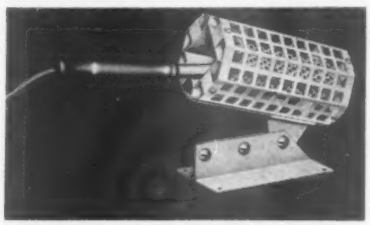
SOLDERING IRON HOLDERS MOUNTABLE THREE WAYS



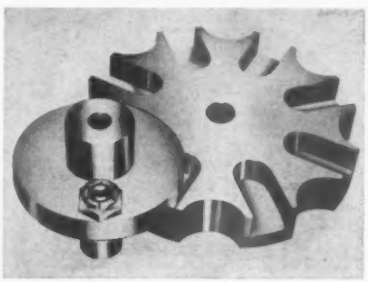
Soldering iron holders are offered to fit most types and sizes of irons. Each can be mounted in three ways.

The Model 55, for irons with heating element casing diameters to 1¼", is equipped with lead-in cone at front, and removable back plate for cleaning out solder dripping.

Wilder Mfg. Co., Mechanic St. and Erie RR, Port Jervis, N.Y.

Use postpaid card. Circle No. 16

STANDARD GENEVA DRIVES FOR INDEXING STATIONS



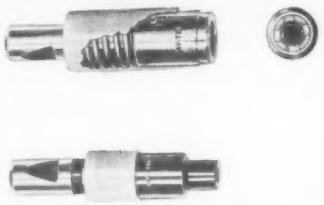
Standard geneva drives are available with 3 to 24 indexing stations for shaft center distances from 3" to 6" in ¼" increments. A wide variety of hub and bore diameters is offered.

The new drives, designed for high speed automation, are available with center distances less than, intermediate, or greater than the standard 3-6" ranges.

Genevamatic Engineering Corp., P.O. Box 10386, Tampa 9, Florida.

Use postpaid card. Circle No. 17

STAKING TOOLS MADE IN STOCK SIZES



Standardized staking tools are offered in 11 sizes from 3/16" to ½" diameter. They can be used with indexing fixtures, on all types of presses for staking ferrous and non-ferrous metal.

The hardened tool steel units have a built-in hold-down and automatic stripper device, actuated by a compression spring. Moving parts are totally enclosed by a protective nylon sleeve.

Jay-Tee Mfg. Co., 1515 N. 25th Ave., Melrose Park, Illinois.

Use postpaid card. Circle No. 18

ARC WELDING HOLDER FOR TIGHT ASSEMBLY JOBS

A "pencil-type" manual holder for tungsten-inert gas welding of light gauge ferrous and non-ferrous metals is ideal for work in places difficult to reach with holders having a conventional head.

The holder accommodates tungsten electrodes from .020" through 3/32" in lengths up to 3", and can be used with argon, helium, or mixtures of these shielding gases.

Air Reduction Sales Co., 150 East 42nd St., New York 17, N.Y.

Use postpaid card. Circle No. 19

WORK TABLE CONVEYOR SPEEDS ASSEMBLY

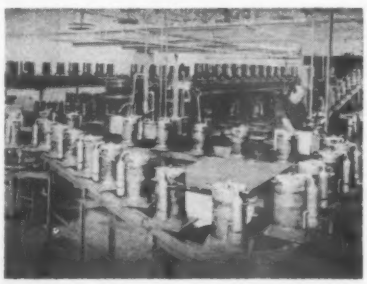


Table-Cable conveyor handles products through assembly at work-table heights. Four-wheel carriers run on angle tracks, carrying light to medium loads on pallets or fixtures.

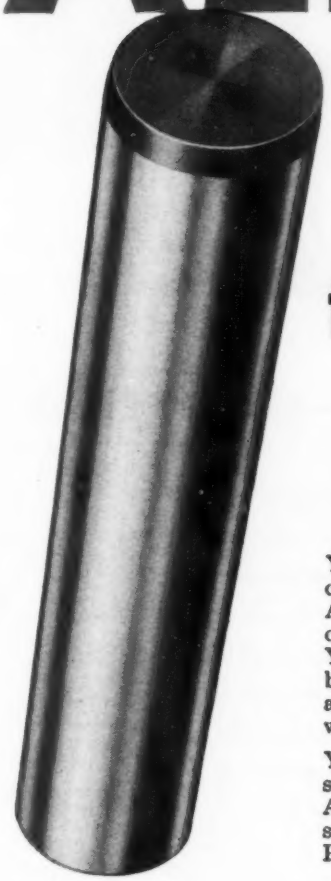
Basically a standard cable conveyor run upside down, the new system is composed of free-running four-wheel trolleys bolted to a cable, with standard blocks for low friction operation on the angle tracks. The fixtures are secured to the trolleys as required.

A variety of smooth functioning turns are included in the selection of components.

E. W. Buschman Co., Clifton & Spring Grove Ave., Cincinnati 32, Ohio.

Use postpaid card. Circle No. 20

ALLEN

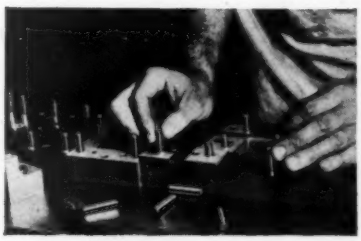


ALLEN is the dowel pin that gives you PLUSES!

Your ALLEN Industrial Distributor can show you a good many ways to use ALLEN Dowel Pins, in addition to conventional uses in tool and die work. You can use them as economical roller bearings, axles, precision plugs, hinge and wrist pins—and in many other ways.

You can cut the cost of your product substantially, too—because your ALLEN Distributor can supply these strong, accurate, mirror-finished Dowel Pins in standard sizes right from stock.

Made of special Allenoy steel; surface hardened to 62-64 Rockwell C; precision ground to .0001" with micro-inch finish of 6 RMS max. Check your Allen Handbook or Catalog for detailed specs and standard sizes, or write direct for samples and technical information.



Genuine ALLEN products are available only through your ALLEN Distributor—he's always ready, willing and able to give you prompt, practical service.

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut

ALLEN HEX-SOCKET SCREWS HEAD

Use postpaid card. Circle No. 237

ELCO®

TYPE 1

THREAD-CUTTING SCREWS

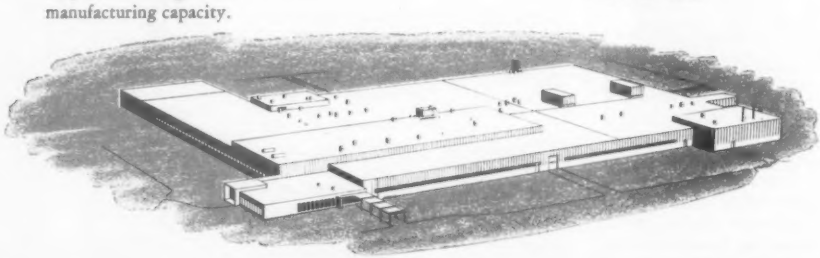
The use of Thread-Cutting Screws means lower costs on the assembly line. However, such savings may be lost unless the right type of screw is selected, and unless the buyer is assured that the screws he gets are of uniform hardness with correctly-shaped threads and sharp cutting edges. *For such assurance — buy from ELCO.*

TYPE 23

TYPE 25

NEW PLANT

You are cordially invited to visit us in our new factory — 242,000 sq. ft. of busy and well-organized manufacturing capacity.



ELCO TOOL AND SCREW CORPORATION

1101 SAMUELSON ROAD, ROCKFORD, ILLINOIS

Use postpaid card. Circle No. 238

WHAT'S NEW IN FASTENING AND JOINING

For further information on any of the fasteners or methods listed here, use the handy postpaid card opposite page 66.

(See 32)

(See 33)

(See 31)

(See 30)

EPOXY ADHESIVE CURES AT ROOM TEMPERATURE

A 100% solids, unfilled, modified epoxy adhesive is formulated to permit pricing at from 1/2 to 1/3 the cost-per-gallon normally associated with similar products of the same chemical family.

Bondmaster B685 was originally developed for bonding polystyrene to rigid surfaces, but tests indicated applicability for general purpose metal-to-metal bonding, including sandwich panels.

The two-part adhesive is free-flowing and at room temperature can be handled in 6-8 hours. It develops 85% of maximum strength in 14-24 hours and may be heat cured in as little as 10 minutes at 250°F with available hardeners.

Rubber & Asbestos Corp., Dept. P, 225 Belleville Ave., Bloomfield, N.J.

Use postpaid card. Circle No. 30

SPRING LOCK WASHERS FOR RESILIENT STEEL SECTIONS

Springlox spring lock washer design permits the use of thinner, more resilient steel sections, while providing reactive tension considerably greater than available from indentical size steel sections in the helical spring washer design.

The washer does not dig in or serrate bolted sections. It is particularly suitable for aircraft applications.

Reliance Div., Eaton Mfg. Co., Massillon, Ohio.

Use postpaid card. Circle No. 31

ADD THREE MINIATURES TO NYLON SCREW LINE

Three new sizes have been added as stock items to a line of molded nylon screws. Machine screw thread sizes No. 0-80, No. 1-72 and No. 4-90 can be produced in a range of lengths and head types.

The No. 4-90 is provided with a jewel socket, incorporates ultra-fine threads for use in meters and other precise applications.

Molded in a Class 2 fit, the fasteners can be used with mating threads in assemblies which require Class 3 fits and better by specifying a female thread with tolerances on the high side.

Gries Reproducer Corp., 15 Second St., New Rochelle, New York.

Use postpaid card. Circle No. 32

PIPE NUT ELIMINATES THREADED JOINT LEAKS

Pipe users—especially in the hydraulic, water and other processing industries—can eliminate threaded joint leaks by installing the Tef-Seal nut together with the usual fittings on all pipe connections.

The nut also substitutes for straight thread "O" ring boss fittings using original female pipe ports, and gives positive seal on directional fittings like tees and elbows without distorting mounting bosses or damaging expensive valves and pumps. The nut is available in nine sizes to fit pipe threads from ⅛" to 2".

The Weatherhead Co., Fort Wayne Division, 128 W. Washington Blvd., Fort Wayne, Indiana.

Use postpaid card. Circle No. 33

LIQUID FLUX FOR ALL SOFT SOLDERS

A general purpose liquid flux is designed for use with all soft solders. It is used on stainless steel, chrome, monel, copper, brass, cast iron, nickel, nickel silver, steel, galvanized, gold, sterling silver, bronze coated steels—all except aluminum, magnesium and die cast.

Duzall eliminates precleaning of parts, removes surface oxides, and expands the capillary action of all soft solders, even on deep joints and tough-to-solder applications. It is non-acid.

All-State Welding Alloys Co., Inc., 249 Ferris Ave., White Plains, N.Y.

Use postpaid card. Circle No. 34

STAINLESS COLD HEADING WIRE IS COPPER COATED

A stainless steel cold-heading wire is wrapped in a protective coating of copper .0002" thick by an electrolytic copper plating machine—the first of its type installed in the cold-heading industry. This coating serves as a lubri-

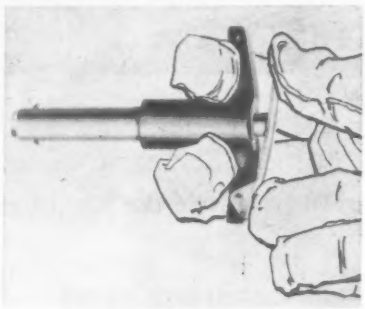
cant in the cold-heading operation.

Poor adherence, lack of uniformity in coating thickness, bare spots and flaking suggested the need for a better and more uniform coating to aid in cold-heading, reported Republic Steel.

Republic Steel Co., Massillon, Ohio.

Use postpaid card. Circle No. 35

FURNISH QUICK-RELEASE PINS WITH LEVER



A spring-action lever can now be specified on the 5440 series single action Pip pin. This will permit a gloved or mittened operator to easily seize and release the pin from its application.

The self-locking, quick-release pins are available in T and L handle styles in diameters from ¼" through 7/16".

Aviation Developments Inc., 210 S. Victory Blvd., Burbank, Calif.

Use postpaid card. Circle No. 36

BUSHINGS PERMIT WALL THICKNESS ADJUSTMENTS

An adjustable wall thickness bushing permits radial dimensions to be varied by a simple mechanical adjustment.

Consisting of a series of alternate male and female segments aligned axially, the application of an axial compressive force to the ends of the bushing causes the male segments to assume a smaller diameter, thus reducing the I.D. of the bushing; while at the same time causing the female I.D. segments to assume a larger diameter, thus increasing the O.D. of the bushing. All segments are slit axially through one wall to provide ease of adjustment.

The bushings can be used with fasteners anywhere a close fit is required; in salvaging oversized holes; as a shaft clamp; with hinge and pivot pins to eliminate backlash.

Globe Bushing Corp., 12036 Vose St., North Hollywood, Calif.

Use postpaid card. Circle No. 37

MACHINE SCREW NUTS COLD PUNCHED FOR ECONOMY

Standard single and double chamfered nuts are cold punched. Machine screw nuts are available in 50 different sizes from stock.

T.N.F. Corp., 1052 E. Elizabeth Ave., Linden, N.J.

Use postpaid card. Circle No. 38

INDUSTRIAL
RETAINING RINGS
cut costs,
simplify assembly

Precision-engineered INDUSTRIAL Retaining Rings . . . internal, external and open types . . . are available in a wide selection of sizes and finishes. Solve your fastening problems simply and economically with the rings that cut machining and tooling expense, save material, simplify and speed assembly.

Series 1000 and 2000 are available *stacked* for quickest application.

Write for free ring samples and catalog.

IRR *Originators of modern retaining ring dispensing*

INDUSTRIAL RETAINING RING COMPANY
Dept. A-1, 57 Cordier Street
Irvington 11, New Jersey
Use postpaid card. Circle No. 239

FOR APPROXIMATELY $50 YOU GET 12 SETS, EACH SET GROUND READY TO GO

Men would not accept either idea at first . . .

INSERT CHASERS SAVE UP TO 33%

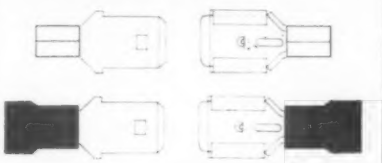
Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For approximately $50 you get a dozen sets of ¾—16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime.

FREE: "UNIFIED AND AMERICAN SCREW THREAD DIGEST."

THE EASTERN MACHINE SCREW CORPORATION, 25-48 Barclay St., New Haven, Conn.

Use postpaid card. Circle No. 240

RELEASE TERMINALS WITH SPECIAL LOCK



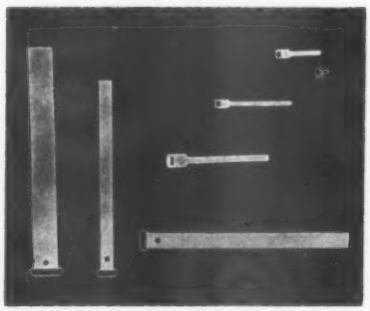
A series of quick disconnect terminals for many switch and control applications, give push-on high-pressure spring-loaded connections that incorporate a special locking action.

The series includes insulated and non-insulated models, straight and flag types. Wire range is 18-14 A. W. G. All feature closed-barrel construction for quick crimping on wire and for a positive connection. Samples.

ETC Incorporated, 990 East 67th St., Cleveland 3, Ohio.

Use postpaid card. Circle No. 39

METAL STRAPS AVAILABLE FROM STOCK



Metal straps for harnessing wires, cables or pipes are available from stock in sizes ranging from ½" to 3⅛" in width and most lengths. Smaller sizes are stamped, larger sizes, assembled.

Lloyd Products Co., 1005 Wayne St., Cincinnati 15, Ohio.

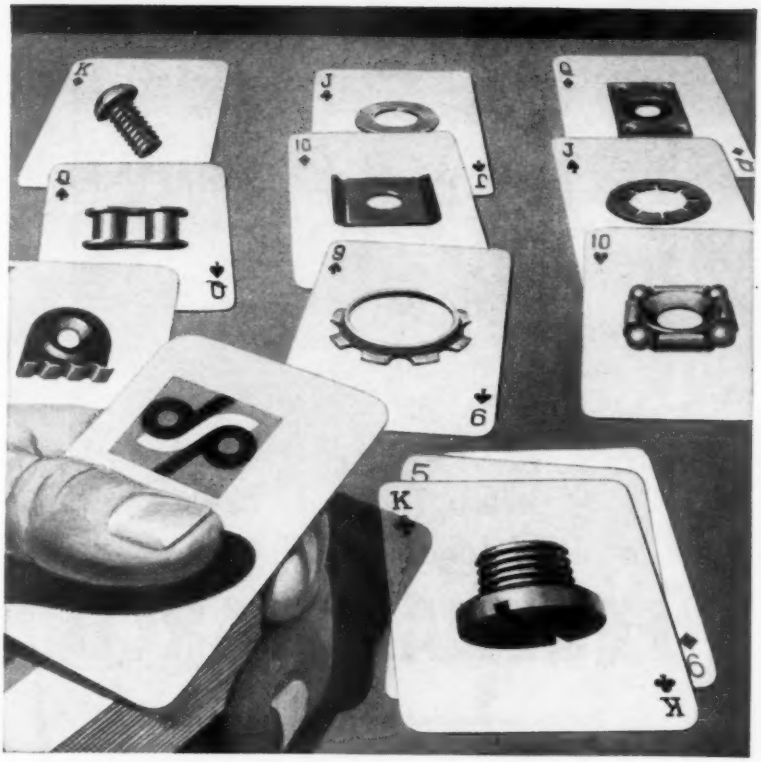
Use postpaid card. Circle No. 40

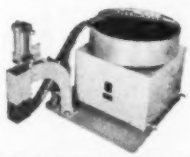
MINIATURE SHAFT COLLARS ADDED AS STANDARDS

Two tiny steel collars for shafts 1/16" and 3/32" in diameter are additions to the Hallowell line as standard items.

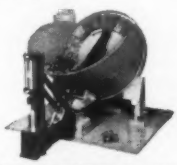
The alloy steel collars are used in taking up thrust, for locking, spacing and positioning shafts and other mechanical applications.

Collars are supplied with Unbrako hex socket set screws, thus hold collar in place with greater clamping force. Set screws are supplied with plain cup point as standard. Other points and the nylon insert self-locking feature are



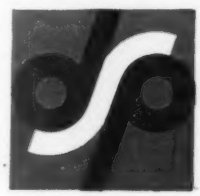


VIBRATORY FEEDER for light, fragile or highly finished parts.



ROTARY FEEDER for high production feeding.

ROTARY HIGH SHELL FEEDER for maximum holding capacity.



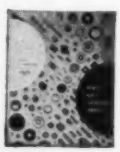
Shuffle and deal parts for automatic assembly with

DPS selective feeders

It takes fast, automatic feeding to satisfy the appetites of today's automatic assembly machines. And nowhere can you duplicate the range of equipment, the specialized experience in selective feeders offered by Detroit Power Screwdriver Company.

The most complete line in industry, DPS parts feeders include rotary, vibratory and elevator types. They handle any product from the tiniest of screws to assembly components the size of your fist . . . range in holding area from eighty cubic inches to 20 cubic feet.

DPS will welcome an invitation to analyze your assembly operations. If lagging production can be traced to inefficient feeding, the problem is as good as answered. Write for catalog on selective feeders.



DETROIT POWER SCREWDRIVER COMPANY 15,036

2815 W. Fort St. • Detroit 16, Michigan

A Subsidiary of Link-Belt Company

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at Whirlpool you'll find . . .

FEDERAL-WARCO

Federal automatic resistance welders engineered to give Whirlpool the production they wanted without sacrificing famous Whirlpool quality. Federal welders are integral parts of many of Whirlpool's production lines, helping form and assemble at extra high speeds without breaking stride.

Leading metal fabricators from coast to coast, especially those who require high production and unsurpassed quality, have learned they can depend on the performance of Federal resistance welders and Warco mechanical presses, precision engineered by:

THE FEDERAL MACHINE AND WELDER COMPANY
WARREN, OHIO

Federal® WELDERS

Warco® PRESSES

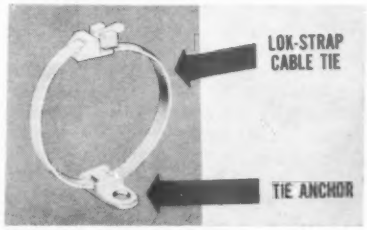
Use postpaid card. Circle No. 242

available as options. For easy identification, bore size is stamped on the face of the collar.

Standard Pressed Steel Co., Jenkintown, Pennsylvania.

Use postpaid card. Circle No. 41

NYLON CABLE TIE WITH QUICK-RELEASE LOCK



Nylon cable ties have a miniature quick-release lock which permits opening and readjusting of wire bundles without special tools.

Used with tie anchors, the Lok-Strap assembly becomes a cable clamp. A plastic tab, with a mounting hole at one end and retaining slot at other end, accommodates the band, which is then snapped around wires.

One size of cable tie will handle harnesses from ⅛" to 1¾" in diameter.

Panduit Corp., Dept. AE-3, 14461 Waverly Ave., Midlothian, Ill.

Use postpaid card. Circle No. 42

SILVER BRAZING FLUX WITH HIGH HEAT TOLERANCE

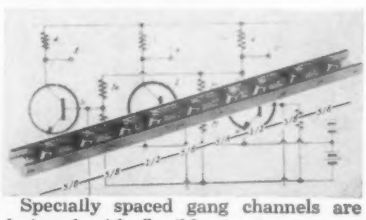
Greater heat tolerance and coverage per pound of material are features of a general purpose brazing flux.

Kwikflux 490 has the ability to remain in solution and retain its strength when diluted with large volumes of water. Samples for 1100F°. to 1700F°. working range are available when writing on company letterhead.

Special Chemicals Corp., 100 S. Water St., Ossining, N.Y.

Use postpaid card. Circle No. 43

SPACED GANG CHANNEL SPEEDS ASSEMBLY



Specially spaced gang channels are designed with flexible spacing to save time on assembly lines.

Specifications of the G1928 unit called for nut spacings of ⅝", ⅝" and ½", in that sequence, which correspond to bolt hole spacings in the electronic equipment which was to be mounted.

The rail of the gang channel is aluminum alloy. Carbon steel nuts are the floating, all metal, self-locking type for 550°F. applications.

Kaynar Mfg. Co., Inc., Box 2001, Terminal Annex, Los Angeles 54, Calif.

Use postpaid card. Circle No. 44

HIGH STRENGTH EPOXY ADHESIVE RESISTS WATER

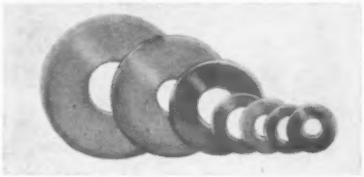
Devcon 2-Ton epoxy glue, long in use in the aircraft and missile industries, has been introduced to the general market in a kit form.

Its white color enables use with enamel and porcelain, leaving a gloss finish stronger than the material itself in less than two hours. It does not discolor, is non-shrinking and resists water and most solvents. Once mixed with a special hardening agent, it is ready for use, requiring no heat or pressure. The finished repair can be matched to the mended original.

Devcon Corp., Danvers, Mass.

Use postpaid card. Circle No. 45

FENDER WASHER LINE WITH 13 SIZES



A line of washers known as fender, plaster, canopy and ceiling type are made of zinc-plated steel. Thirteen sizes from ⅛" through ½" bolts vary from 9/64" I.D. and ⅝" O.D. to 17/32" I.D. and 1½" O.D. The washers are packed in cartons of 100.

Holub Industries, Inc., Sycamore, Ill.

Use postpaid card. Circle No. 46

COPPER-PLATED BLIND RIVET

Copper rivets have been added to the Pop blind rivet line. They are made with a steel mandrel plated with copper and in one size: ⅛" diameter with a grip range from .020" to .125".

Pop Rivet Div., United Shoe Machinery Corp., 140 Federal St., Boston, Massachusetts.

Use postpaid card. Circle No. 47

RUBBER-BASE ADHESIVE BONDS MANY MATERIALS

Three new adhesives with high solids content and low shrinkage for bonding or sealing of irregular mating surfaces and porous materials are able to adhere to a variety of materials such as metal, concrete, fabrics, glass, insulating and wallboards, linoleum, paper, plaster, felt, rigid plastic, cork, stone and wood.

Resistance to both fresh and salt water, good aging properties and high resiliency against vibration and impact are claimed for the adhesives.

The adhesives are rubber base types, noncuring and gain in strength for 24 to 48 hours after use.

B. B. Chemical Co., Cambridge, Mass.

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EXPANDING PRODUCER OF COMMERCIAL AND SELF-LOCKING NUTS HAS OPENINGS FOR ASST. SALES MGR. AND ASST. PLANT SUPT. BOTH WITH EXPERIENCE IN THIS PARTICULAR INDUSTRY

JACOBSON NUT MFG. CORP.
KENILWORTH, N.J.

...Better still with new

MF Whiz-Locks®

One-piece free spinners
that won't let go. So simple they'll amaze you.
So original there's a patent pending.

MacLean-Fogg's new Whiz-Lock is a one-piece, free-spinning lock nut that is simplicity itself. Spin it into place, wrench it tight and forget it. The scientifically designed spiral teeth take just the right grip on the work to prevent accidental loosening. Yet it removes readily on application of at least 25% more torque than was used to apply it.

MF Whiz-Locks have been as thoroughly tested as any new fastening device ever offered. Test them yourself soon. Samples are available free. Ask for hex nuts or bolts—with or without flange—in sizes from No. 6 to ⅜". State size desired.

SEND FOR SAMPLES

MAC LEAN-FOGG
MF LOCK NUTS

MacLean-Fogg Lock Nut Company
5535 N. WOLCOTT AVENUE
CHICAGO 40, ILLINOIS

1926 35 1960
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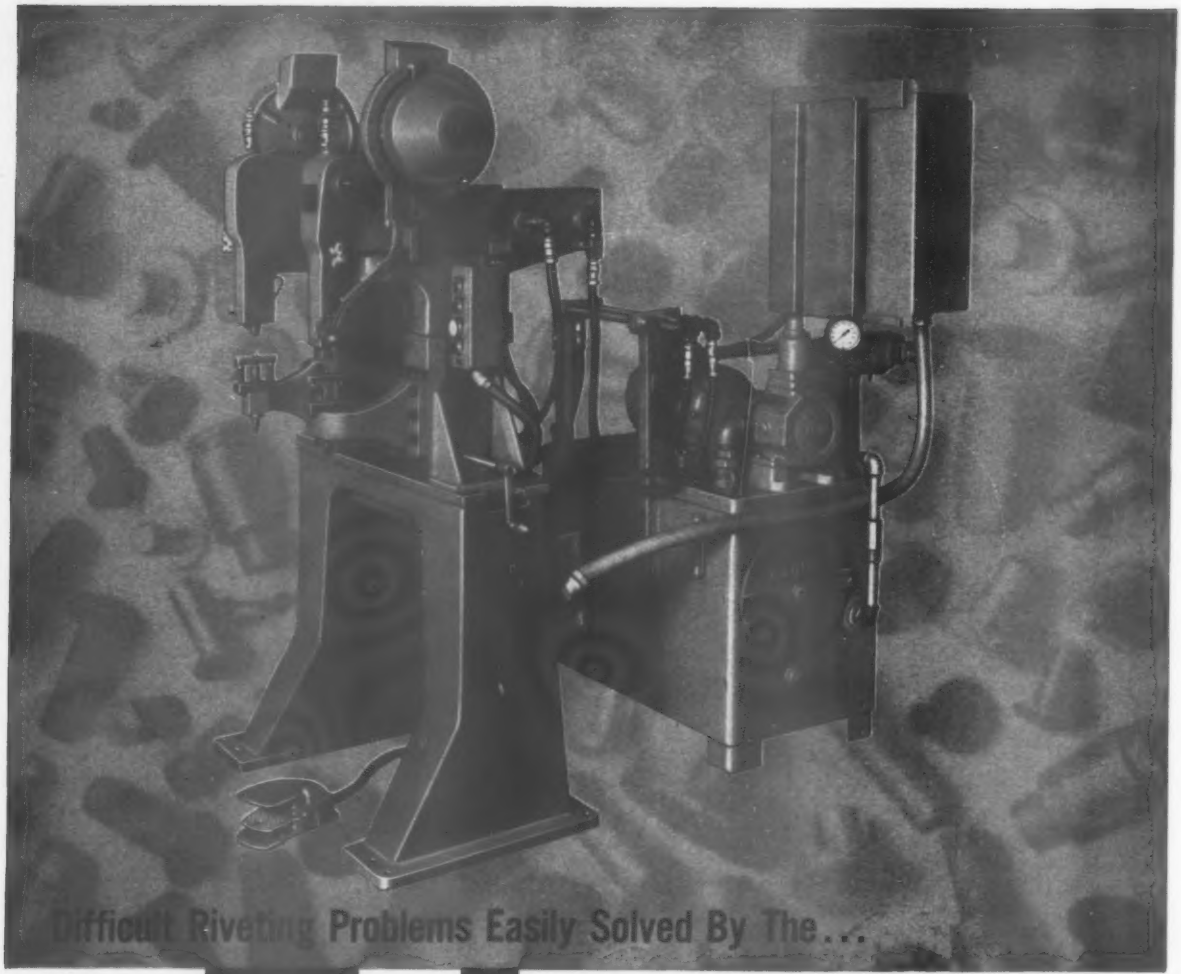

New T-J HYDRAULIC DUAL RIVITOR

With Increased Riveting Production • Quality • Versatility

Added recently to the versatile T-J line of unit and production line riveting and clinching machines is the new Hydraulic Dual Rivitor. The Model HDR will set two ¼″ solid steel rivets at once with adjustable spacing from 1-½″ to 18″ maximum, center to center, being fed from 10″ hoppers. Operating cycle is approximately .8 second, at 420 P.S.I. oil pressure furnished from a hydraulic power unit with maximum of 1000 P.S.I. output. For complete specifications write to The Tomkins-Johnson Co., 2425 W. Michigan Ave., Jackson, Michigan for Bulletin HDR-4-59.

For information on other T-J Rivitors and Clinchors write for Bulletin No. 555.

T-J TOMKINS-JOHNSON
RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

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USEFUL LITERATURE

To receive your copy of any literature reviewed here, use the postpaid card opposite page 66.

SOLDERING IRONS

Case history studies accompany technical information on a line of soldering irons in eight-page publication GED-3553. Quality comparison tests are charted, tip, heating and weight features discussed. General Electric Co., Schenectady 5, New York.

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BLIND EXPANSION RIVETS

Features and use of DuPont "explosive" rivets for blind applications are presented in a revised 10-page bulletin. Head-types and specs, tooling, installation, strength characteristics are given. Heat applied to chemical charge expands the rivet shank. The Bowman Products Co., 850 E. 72nd St., Cleveland 3, Ohio.

Use postpaid card. Circle No. 51

SELF-SEALING SCREW

A hex headed type A screw features an integral, concave washer which seals the screw hole. A two-page flyer check lists advantages and has a large illustration of the fastener with features arrowed. Samples. Great Lakes Screw Corp., 13631 S. Halsted St., Chicago 27, Illinois.

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FASTENER REFERENCE

A large 1960 catalog can be used as a reference for threaded and headed fasteners. List prices are current. Atlas Screw & Specialty Co., Inc., 450 Broome St., New York, New York.

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THREAD FIT PROBLEMS

How and why lead deviation—applied to long thread engagement—causes fit and assembly problems is told in a four-page Bulletin 2498. It includes a set of charts which tell how much screw thread pitch diameter tolerance is consumed by increasing lengths of engagement. Solutions are suggested. Standard Pressed Steel Co., Box 1121, Jenkintown, Pa.

Use postpaid card. Circle No. 54

TORQUE TESTING FIXTURES

How basic fixtures for testing torque are adaptable to laboratory, inspection and assembly line is shown through photos and text in a six-page bulletin. Many typical tests are described. Specifications listed. P. A. Sturtevant Co., Addison, Illinois.

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APPLYING PARTS SEALANT

Technical and application information on Loctite liquid sealant that hardens between metal fasteners and parts is contained in eight-page brochure No. 204. Photos and text describe six case histories. Diagrams show how assembly is simplified. Torque and strength features for 10 sealant grades and military specifications are in table form. American Sealants Co., 103 Woodbine St., Hartford 6, Conn.

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WRENCHES, SHOP TOOLS

Dozens of useful shop tools are included in 68-page Catalog 50. Photos, specifications and text accompany each item and set. A selector chart is given for new American standards. The Billings & Spencer Co., Hartford 1, Conn.

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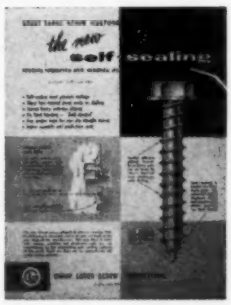
SOLVE SOLDERING PROBLEMS

Preventing silver scavenging, effects of rare metals in soldering, choosing the right alloy when high creep strength is required and other common soldering problems are described in a new technical data sheet "Tips on Soldering." Included is a check list guide to solving soldering problems. Other bulletins are available to help choose the proper



(See 52)

(See 50)

(See 56)

fluxes and for using solder preforms in automatic production. Alpha Metals, Inc., 56 Water Street, Jersey City 4, New Jersey.

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SCREW MACHINING

"Useful Information for The Screw Machine and Estimating Departments," is the topic of the current issue of Die Headlines. The four-page technical house paper has many tables on cutting speeds and production, thread and tap drill size information. The Eastern Machine Screw Corp., Truman & Barclay Sts., New Haven 6, Conn.

Use postpaid card. Circle No. 59

ADHESIVES

Uses and characteristics of each type of industrial adhesive within a large product line is summarized in a multi-folded, pocket-sized flyer. Metal, flocking, polyethylene and general purpose and special adhesives included. Adhesive Products Corp., 1660 Boone Ave., New York 60, New York.

Use postpaid card. Circle No. 60

QUICK-RELEASE FASTENERS

An attractive folder introduces the Pres-Loc quick-release fastener and contains three series of data sheets on strength performance. Specifications, design tips and installation instructions are included. Test reports are certified by Almay Research. Deutsch Fastener Corp., Box 61072, Los Angeles 61, Calif.

Use postpaid card. Circle No. 61

ELECTRICAL CONTACTS

Highlight of Catalog 601 is an outline recommending electrical contacts for various applications such as contactors, instruments, circuit breakers, switches. Materials, types and features of all contacts are presented. Gibson Electric Co., Old William Penn Hwy., Delmont, Pennsylvania.

Use postpaid card. Circle No. 62

SELF-RETAINING FASTENERS

With a "squeeze, tap or bend" parts are quickly and securely joined. Standard clip-on, self-retaining fasteners are described in an eight-page brochure. Riv-it applications in appliance, automotive, fabricated product, electrical industries are illustrated. Robin Products Co., 27027 Grosebeck Highway, Warren, Mich.

Use postpaid card. Circle No. 63

CONVEYORS

"To produce a unit or system to move a specific material or part in the most efficient and practical way possible," tells a firm's objective described in text and photos in a four-page brochure. Standard and special conveyors shown. Jorgensen Conveyors Inc., 6208 N. 38th St., Milwaukee 9, Wis.

Use postpaid card. Circle No. 64

ASSEMBLY HAND TOOLS

A neoprene handle screwdriver said to give 50% greater torque is featured in a 16-page catalog. Other assembly tools include wrenches, nut drivers, pliers. List prices, illustrations and description are given. The Bridgeport Hardware Mfg. Corp., Scofield Ave., Ext., Bridgeport 5, Conn.

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BRAZING STAINLESS STEEL

Facilities for brazing and processing stainless steel are described in a four-page brochure. Assembly services are also available. Metallurgical problems handled. Aerobraze Corp., 30012 Lakeland Blvd., Wickliffe, Ohio.

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ASSEMBLY BY DIE CASTING

High speed assembly of small parts on a semi-automatic machine by die casting is outlined on a one-page flyer. Typical applications, a picture of the machine and design simplification features are included. Fisher Gauge Works Limited, Peterborough, Ontario, Can.

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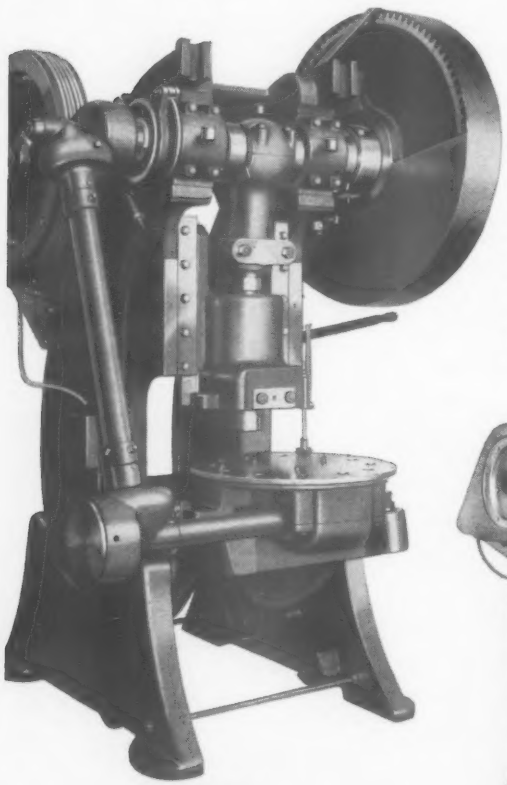
Modern FEDERAL Dial Feeds give you

automation at less cost!

—eliminate specialized and more costly equipment!



Federal Dial Feeds are your answer to greater production at lower costs. Equipped with special jigging, automatic feeds and ejectors, their applications are virtually unlimited and the need for specialized, more costly equipment often eliminated. (Example, one manufacturer increased production 600%.)

Add Federal's quality features and workmanship... and you've got a winner. Investigate Federal Dial Feeds for your operations. Gear or chain driven with cam-type indexing mechanisms. Sizes range from 6 to 80 tons.

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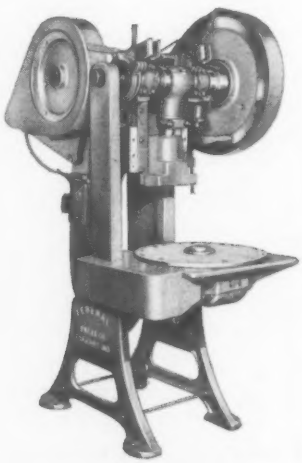
Gear Driven. Capacity, 80 tons.



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Chain Driven. Capacity, 26 tons.

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FEDERAL DIAL FEED PRESSES
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DESIGNING WITH NUTS

An 80-page catalog No. 5918 guides in the selection of self-locking nuts for temperatures over 800°F. Problems of stress rupture, creep and relaxation strength are discussed. Over 50 pages of dimensional drawings are indexed by temperature ranges. Elastic Stop Nut Corp. of America, Dept. H, 2330 Vauxhall Rd., Union, N.J.

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TESTING MACHINES

Two new machines pictured and described in four-page Bulletin 1158 test torque and calibrate torque wrenches. Other units test hardness, compression, ductility and other characteristics. Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Michigan.

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PARTS DEGREASER

Units designed for high-volume, automatic cleaning and degreasing of parts are featured in a four-page brochure. The how and why of the Vibra process is described. Units are pictured. Manpro Corp., 1360 Hilton Rd., Detroit 20, Michigan.

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RESISTANCE WELDERS

A line of standard resistance welders is introduced in six-page Bulletin G-56. Press and rocker arm spot welders, spot projection and seam welders and special application units are described in large and quick-scanning type. Banner Welder Inc., 6820 N. 43rd St., Milwaukee 9, Wisconsin.

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WELD NUTS

Methods for cutting assembly time and costs through pre-assembly with projection-weld nut is told in Bulletin 7764. Specific user applications, automatic tooling, welding set-up and procedure are topics discussed. Midland-Ross Corp., Owosso Div., Owosso, Mich.

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HOT HEADING FASTENERS

Technological advances in hot forging fasteners are expounded in an eight-page booklet. How hot heading can furnish unlimited lengths in bolts, wider diameter ranges, cost savings under certain conditions, greater upsets, are discussed. H. M. Harper Co., 8200 Lehigh Ave., Morton Grove, Ill.

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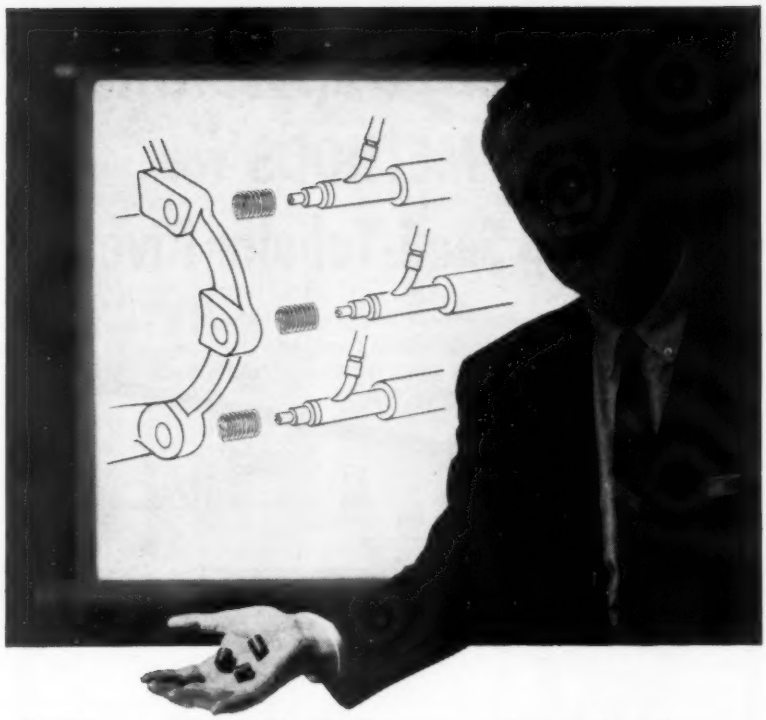
TUBULAR RIVETERS

Automatic tubular riveters are described in a four-page brochure as cost cutting by being fast and adaptable to product design changes. Four basic



"These Heli-Coil® Inserts give aluminum tapped holes the strength of steel threads in the new FORD transmission housing."

Threads in the starter mounting pad in the new Ford aluminum transmission housing would have been too soft to resist wear under vibration, impact and removals of the starter for service. ***Heli-Coil*** steel wire inserts eliminate this problem, are installed automatically with ***Heli-Coil*** designed equipment.

Now you can design aluminum assemblies and provide permanent internal steel threads for use with steel screws or studs. And ***Heli-Coil Corporation*** also supplies high-speed, automatic installation equipment to meet mass-production schedules economically.

Opening the door to exciting new design possibilities, *Heli-Coil* Inserts:

- hold fasteners secure under impact and vibration
- prevent thread wear, stripping, corrosion, galling and seizing
- allow repeated assembly and disassembly without loss of thread strength
- can be used in standard proportion bosses without need for redesign
- are available in a complete range of U.N.C. and U.N.F. thread sizes as well as spark plug and pipe thread series
- save assembly time, space, weight and cost
- have full industrial and military approval

HELI-COIL CORPORATION
DANBURY, CONNECTICUT

HELI-COIL CORPORATION, 3101 Shelter Rock Lane, Danbury, Connecticut
I'd like more information on *Heli-Coil* Screw-Thread Inserts
NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____ 1582

In Canada: Armstrong Beverley Engineering Ltd., 6975 Jeanne Nanse St., Montreal 15, Que.

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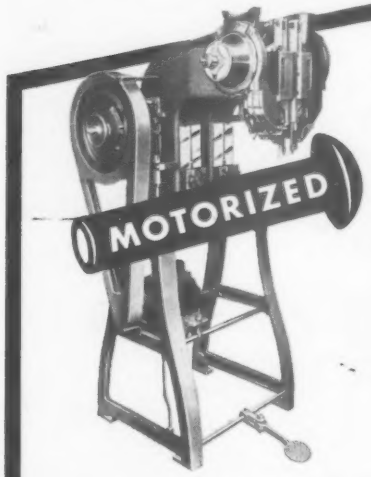
Why *Chicago Rivet* Offers TWO METHODS for Clinching Semi-Tubular Rivets

It is part of a widening service based upon industry's recognition that an assembly held together by semi-tubular rivets has great inherent strength and is usually lowest in production cost.



The Chicago Rivet MOTORIZED AUTOMATIC RIVET SETTER produces a sharp, solid blow that immediately upsets the tubular section. This method is used on 95% of all applications involving metals or non-fragile materials.

The Chicago Rivet AIRPOWERED RIVETER produces a cushioned, shock-free clinch on a tubular rivet, permitting riveting of fragile and uneven materials. This method has greatly widened the use of semi-tubular rivets.

FOR YOUR FILES

RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

AIR-POWERED RIVETING catalog contains description and specifications of 8 single and multiple riveters—also rivet setters designed for automated operation.

Why not let Chicago Rivet Fastening Engineers tell you which system is best for you. No obligation.

MOTORIZED

Line includes automatic single, multiple and automated setters.

AIR-POWERED

Line includes automatic single, multiple and automated setters.

Chicago Rivet
& MACHINE CO.
946 So. 25th Ave., Bellwood, Ill.
(Chicago Suburb) Branch Factory:
Tyrone, Pa.

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machine styles are pictured and specified, with examples of how they are used. Tubular Rivet & Stud Co., Weston Ave., Quincy 70, Massachusetts.

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CLAMPS

Thirty-two variations of six types of clamps (hook, loop, hinge, spring loaded, special duty, gear lock) are specified in attractive 18-page Catalog CF57. Dimensions, illustrations and applications are given for each clamp. The Bassick Co., Howard Ave., Bridgeport 5, Connecticut.

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INDEXING UNITS

Literature on cam-operated indexing units for assembly machines includes a 22-page booklet with large dimensional drawings of available models, a price list and descriptive brochure. Standard Tool & Mfg. Co., Kearny, N.J.

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SINTERED BRASS PARTS

An eight-page brochure describes the process of fabricating high-strength nuts and washers from brass powder. Prices are listed for standard hex and square nuts and flat washers. Special nuts are easily molded. Midwest Sintered Products Corp., 13605 S. Halsted St. (Rear), Chicago 27, Ill.

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METAL STAPLING UNITS

Air-powered staplers are featured in a 16-page catalog. Application photos and text describe the portable machines which drive staples of all sizes through light metal, wood and other materials. Hog ring pliers, hand staplers and machines are also specified. Power-Line Sales, Inc., 540 Monterey Pass Rd., Monterey Park, Calif.

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ELECTRODE HOLDERS

Standard resistance welding electrode holders, adapters and accessories are specified in 20-page Catalog 8-62A. Each of 14 types of holders is drawn in cross-section, with engineering data supplied. P. R. Mallory & Co., Inc., Indianapolis 6, Ind.

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assembly and fastener engineering

JANUARY, 1960

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JANUARY, 1960

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AUTOMATIC SCREWDRIVING

How the Tru-Tork power screwdriver can cut assembly costs up to 60% is explained in a four-page bulletin. The portable gun will feed and drive screws, rivets, studs, pins up to 2" long to pre-determined torque. Clyde Engineering & Mfg. Corp., Madison Heights, Mich.

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THREADED INSERTS

The Lok-Thred principle of carrying work loads is told in an eight-page bulletin on threaded, metal inserts. Through, pipe and blind tapped types are specified. Pull test, installation torque and fatigue load data is charted. Lock Thread Corp., 2832 E. Grand Blvd., Detroit 11, Michigan.

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ELECTRIC CLIPS

Electric clips—from miniatures to welding ground clamps—are pictured and described in Catalog 220. New developments include skin-tight insulators, colored insulators and new alligator clips for special applications. Mueller Electric Co., 1592 Q, E. 31st St., Cleveland 14, Ohio.

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AIR STAKER, PRESS

A combination arbor and staking press for small parts assembly is introduced in a four-page bulletin. How the tool operates, its accuracy and adaptability are discussed. Components are shown in a cross-sectional drawing. Cramer Control Corp., Centerbrook, Connecticut.

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BAND CLAMPS

Technical data and design information on standard clamps is contained in a 16-page catalog. Circle, bracket, multiple take-up clamps and bands in steel and aluminum alloy are specified, specials discussed. Graphs detail latch torque vs. band tension, strength of standard parts and material specifications. National Utilities Corp., 826 S. Arroyo Parkway, Pasadena 2, Calif.

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STUD WELDING EXPLAINED

Stud welding designs and specifications, and a description of the system, are detailed in a 50-page booklet. Each standard spec page has dimensions, typical uses, ordering and specifying information. Weight chart and special machining operations are described, as well as installation equipment. By letterhead request. KSM Products, Inc., Merchantville, New Jersey.

PLANETARY THREAD ROLLING MACHINE CUTS COSTS

Rolls Screws, Bolts and Nails

400 TO 800 PIECES PER MINUTE

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IMPROVES QUALITY
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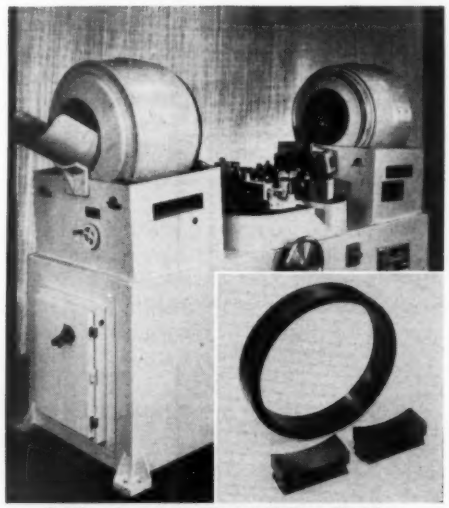

Prutton Planetary Thread Rolling Machine Model 125A-24

When you stop lost motion you start cutting costs. That is the basic idea behind Prutton's Planetary die system. This Model 125A-24 Prutton Thread Roller produces 400 to 800 threaded parts per minute—class 3 fit. It easily handles thread rolling; roll forming; knurling; serrating and necking. It rolls diameters .090 to 5/16" and can apply threads up to 3 inches long. Special models handle blanks up to 8 inches long.

Die life of five million pieces is not unusual because the Prutton Planetary Die has 36 inches of working surface. Conventional machines would require a five foot stroke to handle equivalent die area. But, the Prutton Planetary Die measures only 12 inches across and the entire machine occupies a mere 18 square feet of floor space. One Prutton can replace four or more conventional machines.

Write or Phone for Cost Saving Information, TODAY!

Prutton
CORPORATION
5295 WEST 130th STREET
CLEVELAND 30, OHIO

Leader in Planetary Thread Rolling

JUST PIN THIS COUPON TO YOUR LETTERHEAD

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Please send information on Model 125A-24 Thread Rolling Machine.

Name ..... Title .....
Company .....
Street Address .....
City ..... Zone ..... State .....

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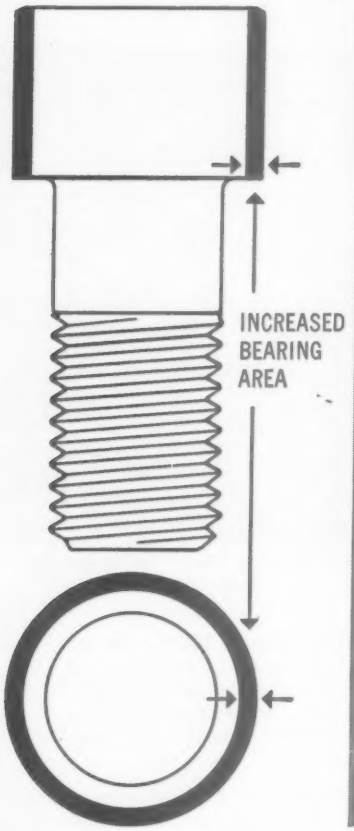
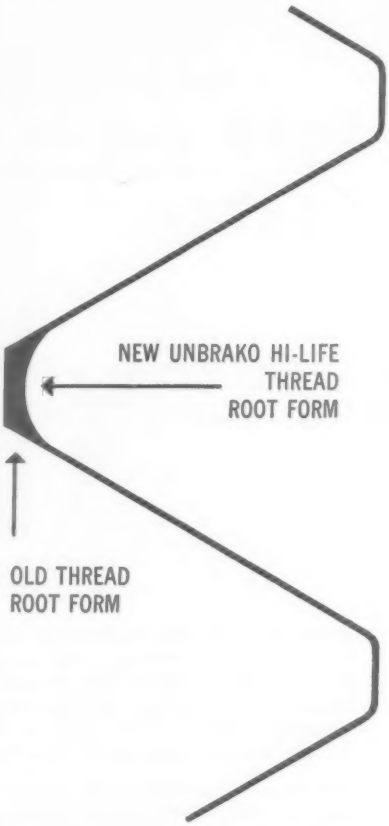
A MAJOR DEVELOPMENT IN SOCKET CAP SCREW DESIGN!

UNBRAKO *pHd** with Hi-Life thread— the advanced fastener for the 60's

Stronger in the head



Stronger in the thread



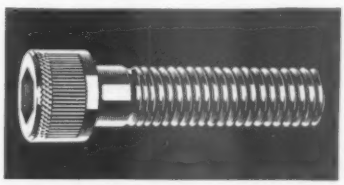
UNBRAKO pHd design features increased bearing area under the head, bigger wrenching socket; provides up to 2⅓ times as much holding power without indenting bolted material. By permitting higher preloading, pHd helps eliminate fatigue failures, reduces possibility of screws working loose under shock and vibration.

New UNBRAKO Hi-Life thread form has smoothly radiused root, slightly more metal at minimum cross section. Result: up to 100% greater fatigue life, plus a bonus in added tensile strength. Only UNBRAKO gives you the new, larger pHd head design and the improved Hi-Life thread . . . in a standard screw at no extra cost.

Anticipating tomorrow's demands today, SPS now offers you a standard socket head cap screw that incorporates both the UNBRAKO pHd design (1960 Series) *and* the new UNBRAKO Hi-Life thread.

This combination gives you a fastener that is unequaled in strength and performance. Because of its increased bearing area and bigger socket, you can tighten it tighter without deforming screw or bolted material. Thus you get more holding power—up to 2⅓ times as much, in fact. And because of both increased bearing area *and* new radiused thread root, the UNBRAKO pHd Hi-Life is almost twice as strong in fatigue.

The pHd head and Hi-Life thread —both originated by SPS—are tangible results of a continuing program of basic research in the design and performance of threaded fasteners. And they reflect to no little degree SPS experience in developing special high-strength fasteners for aircraft/missile use. Nevertheless, this new UNBRAKO is available to you as a standard—at no increase in price. For complete data, write SPS—manufacturer of precision threaded fasteners and allied products in many metals, including titanium.



New UNBRAKO pHd socket head cap screws with Hi-Life thread are available now from your authorized industrial distributor in standard sizes ¼ through 1 inch, plain or cadmium plated. Available also with the Nylok† self-locking feature. NOTE: UNBRAKO pHd Hi-Life screws fit standard tapped holes, require no special gaging.

†T.M. Reg. U.S. Pat. Off., The Nylok Corporation

INDUSTRIAL FASTENER Division

JENKINTOWN 78, PENNSYLVANIA

SPS

*pHd stands for "proper head design"—a factor in higher product reliability

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INDUSTRY MAKES NEWS

H. Thomas Hallowell, Jr., president of Standard Pressed Steel Co., accepts "Growth Company of the Year" award from William T. Mabee, president of the National Association of Investment Clubs. The award was made in St. Louis, Mo.

Even as the National Machine Tool Builders' Association's statistic of shipments tends to be an excellent long range economic barometer, the Fasteners' statistic is intended to be a valuable short range barometer. Note the high correlation between shipments and the effects of the 1958 recession and late-1959 steel strike. The chart is seasonally adjusted and fastener shipments are shown along with Federal Reserve Index metal fabricating and industrial production tabulations.

SPS NAMED "GROWTH COMPANY OF YEAR"

The annual "Growth Company of the Year" award of the National Association of Investment Clubs has been presented to Standard Pressed Steel Co., of Jenkintown, Pennsylvania.

H. Thomas Hallowell, Jr., president, in acknowledging the award stated that SPS's total sales volume this year should reach a new record high of approximately $85,000,000 compared with $64,700-000 in 1958, the previous high year. Describing the growth of the company in the post-war years, the SPS president reported that net worth has increased to more than eight times the net worth at the end of 1944—just 15 years ago.

FORM AUTOMATIC WELDING ASSOCIATION

"The newly-formed Automatic Welding Machinery Association does not overlap the function of any of the other groups in the welding field, and because of this, has a most important role to play."

So says E. W. Hollis, president of AWMA; Hollis is also vice president of the Lewis Welding Company of Cleveland.

"Handling, positioning and manipulating working pieces and welding heads on an automatic basis, to bring them into the proper relationship to one another for fusion, constitutes the science of automatic welding," Hollis explained. Headquarters are The 1010 Euclid Bldg., Cleveland 15, Ohio.

FASTENER SALES TRENDS TO BE INDEXED

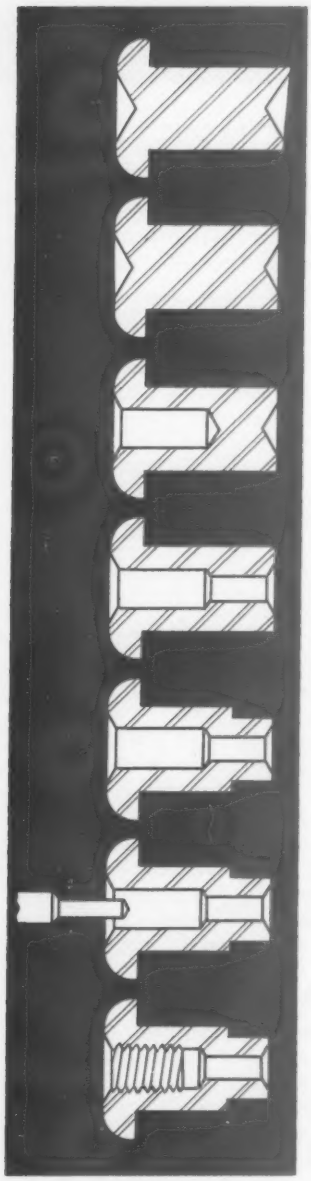
The Industrial Fasteners Institute, Cleveland, Ohio, has prepared an index of shipments which it will issue monthly, intended to be a sensitive short range economic barometer.

All fasteners are by nature components of some other assembly, so manufacturers who order fasteners (bolts, nuts, rivets and screws, in this instance), do so generally on a schedule-for-use basis. Increasing shipments of fasteners, then, are indications of a spurt in metal manufacturing, and decreasing shipments are a sign of a slow-down in the immediate future.

The Index is derived from the dollar volume of shipments each month by a representative group of

continued

MULTIPLE OPERATIONS
on COLD HEADED PARTS



All operations performed simultaneously

Feed once for all operations

Mill shank end square (Corrects angular cut-off; makes length exact; provides superior, even crimping all around)

Tap drill

Drill thru from shank end (Faster than with long stroke required by drilling from head end)

Hollow mill, concentric with hole & body (Smooth finish; no burrs; simple, inexpensive tooling)

Probe, to be sure both holes are drilled before tapping

Tap

50 to 120 pieces completed per minute, depending on size and material

BECO Multi-Spindle Machines

means fastest production and least labor cost

BATCHELDER ENGINEERING CO.

Springfield, Vermont

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fastener manufacturers compared to their average shipments for the base period 1947-49.

The industrial fastener industry approaches a volume of one billion dollars per year. The Bureau of Census measured its value for the years 1955-57 as $951 million, $941 million and $954 million.

GARDNER-DENVER, APEX MACHINE TO MERGE

An agreement to combine Apex Machine & Tool Co., Dayton, Ohio, with Gardner-Denver Co., Quincy, Ill., was announced jointly today by G. V. Leece, president of Gardner-Denver, and C. A. Lange, president and general manager of Apex.

Apex will become a wholly-owned subsidiary of Gardner-Denver on March 1, 1960, continuing to operate under the same officers, produce the same products and sell through the same sales organization as at present.

The agreement calls for an exchange of more than $6,000,000 in current market value of Gardner-Denver common stock for all of the stock of Apex. Apex has two plants in Dayton with a total of about 74,000 square feet of floor space. The company has 250 employees and a sales organization with offices in 25 cities.

Gardner-Denver is celebrating its Centennial this year as a world-wide industrial firm. It has 4000 employees.

MANAGERIAL CHANGES AT CHRYSLER

CRAWFORD

William C. Cawthon is the new general purchasing agent at Chrysler Corp., and his vacancy as manager of the Plymouth Detroit assembly plant has been filled by Kenneth S. Crawford.

Crawford had been production manager at the plant since Oct. 1 and previously at the Evansville, Ind., plant as manager of manufacturing engineering and plant manager.

Cawthon has been with Chrysler since 1947 and held posts with Dodge and Plymouth. Both men come from engineering backgrounds.

AP&S ADDS NEW ENGLAND DISTRIBUTOR

The American Platinum & Silver Division of Engelhard Industries, Inc. has named Austin-Hastings Company, Inc., Cambridge, Mass., a distributor in New England.

KSM EXPANDS SALES OPERATIONS

KSM Products, Inc., Merchantville, N.J. has widely expanded its sales program with new offices and warehouses in many parts of the United States.

John T. Rayner will supervise 11 western states. Directing new offices in San Francisco and Portland-Seattle are William Mahncke and William Kirksey.

Claude A. Batuk was named manager of a new Halsted Ave. warehouse in Chicago. Joseph Golden opens a Milwaukee operation.

UNITED-CARR ELECTS POOL TO BOARD

Election of E. J. Pool of Elmhurst, Ill., to the board of directors of United-Carr Fastener Corporation, Boston, Mass. was announced today by Samuel A. Groves, president of the Corporation. A graduate of the University of Washington and a pioneer in the radio industry, Pool became president of United-Carr's Cinch Manufacturing Company division in 1958.

WELDING SHOW SET FOR LOS ANGELES

The American Welding Society will hold its 41st Annual Convention and Welding Exposition April 25-29, 1960 in Los Angeles, California. Technical meetings will be held in the Biltmore Hotel, April 25-29, and the welding show in the Great Western Exhibit Center, April 26-28.

For further details write: Information Center, American Welding Society, 33 West 39th Street, New York 18, N. Y.

LYON BUYS NEW WEST COAST PLANT

Lyon Metal Products, Inc. of Aurora, Ill. announced the purchase of a manufacturing plant on the West Coast. The plant, only two years old, covers 160,000 square feet, with more than 16 acres of land for expansion. It is located 18 miles from downtown Los Angeles.

The Los Angeles district sales staff and warehouse operation will move immediately into the new Lyon offices, which are a separate part of the acquisition. The complete equipping of the new plant with manufacturing and finishing machinery will require almost a year. It is expected that the manufacture of Lyon's major product line will start late in 1960. A complete warehousing function from the new plant will operated in the interim period.

MASTER POWER NAMES GENERAL MANAGER

Master Power Corporation of Bedford, Ohio, has named Harry L. Williamson, Jr. to the position of vice-president and general manager. He succeeds Leonard J. Roll, who has been made secretary and assistant treasurer.

Williamson became general sales manager when the company was formed in April, 1959, as a subsidiary of The Black & Decker Mfg. Co. of Towson, Md. He came to Black & Decker in July, 1958 from General Electric Co., where he was manager—marketing, Weathertron Division.

INGERSOLL-RAND ELECTS ALDERSON V-P

Ingersoll-Rand Company has elected W. T. Alderson vice president. Alderson previously manager of the company's compressor engineering department, will be located in New York. A 1923 electrical engineering graduate of Johns-Hopkins University, he joined Ingersoll-Rand in 1927 after service with General Electric Company as an industrial engineer.

NORRIS-THERMADOR BUYS RUSSELL BOLT

Norris-Thermador Corp., Los Angeles, Calif., has purchased for cash the Russell Bolt & Mfg. Co., Los Angeles. K. T. Norris, chairman, commented that the acquisition added a broad line of fasteners to the metal products made by Norris-Thermador. Russell sales for the year ending July 31 were $4.8 million.

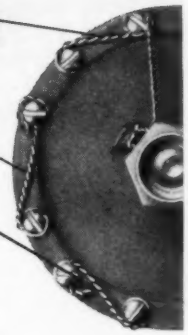
RB&W SIMPLIFIES FASTENER PRICING

Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y., has further simplified its pricing and nomenclature of industrial fasteners. The program was begun in June 1959. Suggestions from customers and distributors were incorporated into the new price lists and discounts, effective with November shipments, according to John S. Davey, vice president in charge of sales.

"Most pronounced need was for list prices having some degree of permanency so customers could figure costs accurately and so distributors might use them in their cata-

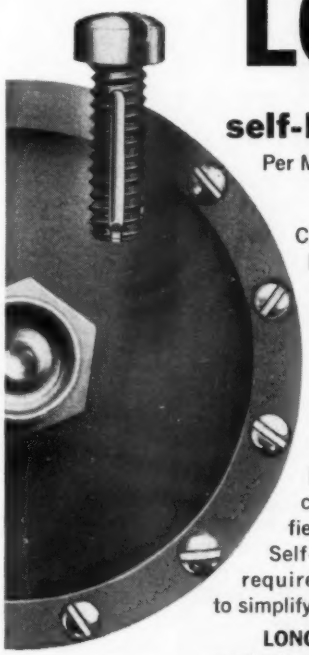
continued

eliminate safety wire



on airborne accessories with...

LONG-LOK



self-locking screws

Per MIL-F-18240

Critical **weights** and needless and costly man-hours of **assembly time** are being saved through the use of **LONG-LOK** Self-Locking Screws on pressure switches, motors, pumps, valves and other airborne accessories.

Many companies in the aircraft, missile and rocket fields are using **LONG-LOK** Self-Locking Screws per the requirements of MIL-F-18240 to simplify their assemblies.

LONG-LOK Self-Locking Screws are heat, vibration, shock and impact resistant. They are reuseable and can be head marked for self-lock identification per specification. Increased reliability of component **and** system is assured.

LONG-LOK Self-Locking Screws are solving new fastener problems every day. They could be the answer to your needs.

Write for Catalog LL-59.

LONG-LOK CORPORATION

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logs," said Mr. Davey. "To do this, some lists were revised so that they all bear a direct relation to cost. Any change can be taken care of by changing the discount—we don't anticipate issuing new lists for some time to come," he said.

The most important nomenclature change is to eliminate duplicate lists and multiplicity of names for identical hexagon-headed products.

Other changes made by R B & W include the following.

Since square nuts are becoming obsolete, all lists, except step and elevator bolts, are figured with hex nuts.

Because some distributors and customers order hex screws and hex nuts packaged separately instead of in the same package, lists are made up so this can be done at no extra cost.

The increase in distributor stocking of zinc plated material called for adding plated lists for the popular products. By applying different discounts, these lists cover both package and bulk orders.

To facilitate computing the price of bolts longer than listed, a new table has been added.

ILLINOIS TOOL PROMOTES SHAKEPROOF MAN

RUSSELL

FULLER

Illinois Tool Works, Chicago, has elected Eugene W. Fuller executive vice-president and James R. Russell vice president and chief financial officer.

Fuller began with the company in 1928, was appointed sales manager of the Shakeproof Division in 1938, general manager in 1947. He was elected vice president in 1950. Fuller is a director of the Industrial Fasteners Institute.

Russell joined Illinois Tool in 1939, was elected secretary in 1953 and treasurer in 1957. He will continue in these additional capacities.

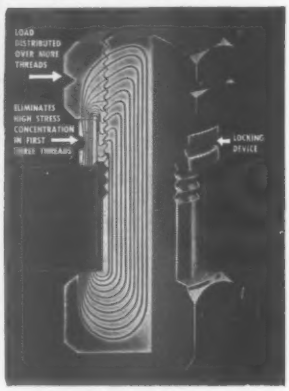
POP RIVET APPOINTS FIELD MEN

Two new representatives—one for sales, the other for distributor recruitment—are announced by the Pop Rivet Division of United Shoe Machinery Corporation. They are Kenneth E. Noyes as sales representative for the New England area, and F. Roger Byrnes as distributor representative for the midwest area.

HUCK ADDS ENGINEERING REPRESENTATIVES

Three new engineering representatives have been appointed by Huck Mfg. Co., Detroit, to assist fastener users in their territories: William M. Freeberg, Oklahoma and northern Texas; Robert J. Fraser, San Diego, San Bernadino, Riverside, Orange and Imperial counties, Calif.; George F. Parker, southern Indiana, nothern Kentucky and southern Ohio.

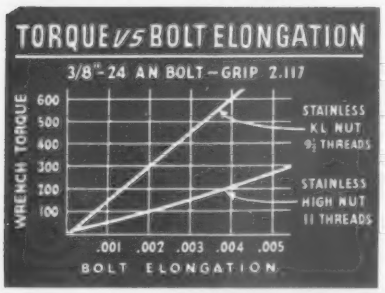
. . . take advantage of ALL the STRENGTH designed in your bolt!



. . . has no equal where TENSILE STRENGTH, VIBRATION, CORROSION, HIGH TEMPERATURE ARE FACTORS!

On the severest of all jet engines, race car and like applications, Klincher has been tested, proved and acclaimed for these outstanding advantages:

- Can be re-used many times!
- Saves time, labor installing, removing!
- Only one piece to stock and handle!
- Ideal for standard and power wrenches!
- Manufactured in various materials!

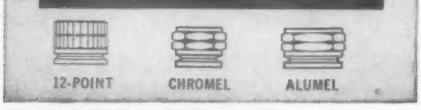


Inquiries are invited regarding special locknut problems involving shank nuts, weld nuts, channel nuts and others. Write for data and samples, giving size and application. Address Dept. D-1.

Write for data and experimental samples, giving size and application.

Address Dept. AF-1.

Klincher LOCKNUT CORPORATION
2153 Hillside Ave.
Indianapolis, Indiana



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BOLTS 'N NUTS FROM REPUBLIC

"Now where can I buy a hammer to pound them into the wood?" • Adv. Republic Steel

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DESIGNER CREDE CITED BY ASME

A new award, given by The American Society of Mechanical Engineers for outstanding achievement in machine design, has been won by Charles E. Crede, associate professor of mechanical engineering at California Institute of Technology.

ASME is citing Professor Crede as "an inspired leader in the field of shock and vibration, who through eminent achievement by creative contributions in the research, development and application of shock mounts, has advanced the field of machine design and furthered interest in shock and vibration control."

He had been vice president of Barry Controls, Inc., leaving in 1958 to become assistant professor at Cal Tech.

FIVE ENGINEERS JOIN SOLAR AIRCRAFT

Five recently-added engineers have been named to positions at Solar Aircraft Co., San Diego. Morris Lebovits, who joined Solar in April from Northrop, has been promoted to chief of astro-aero sciences. Ben C. Axley, Jr. is the new chief of arionics, coming from Lockheed Missiles. Hans W. Weickardt, chief of stress analysis, previously held the same position with Brown Engineering Corp. at Redstone Arsenal. Brian M. Gallagher comes from General Motors as a senior design engineer.

HOUDAILLE ACQUIRES CALMORE-BUFFALO

Houdaille Industries, Inc., Buffalo, N.Y., has purchased Calmore-Buffalo, Inc., Buffalo. Calmore-Buffalo produces the Zipp screw feeder which will now be manufactured by Wales-Strippit, Inc., a unit of Houdaille Industries, in their Akron plant.

BUCKEYE STAFFS NEW DETROIT OFFICE

Buckeye Tools Corp., Dayton, Ohio, has established a new Detroit office at 17311 W. Seven Mile Rd. with a three-man staff. Hugh H. Harris, 19-year Buckeye veteran, will direct the firm's National Automotive Specialist program. Jack K. Wilson will be sales engineer and Mike Kirkpatrick, service and repair.

H. M. HARPER OPENS SYRACUSE OFFICE

The H. M. Harper Co., of Morton Grove, Ill., opened a new branch office at 109 Baker Street, East Syracuse, N.Y. Edward M. Welty is the eastern regional manager and Dana Lincoln is the district manager.

DETROIT STAMPING APPOINTS DISTRIBUTOR

Erie Industrial Supply Company, Erie, Pa., has been appointed northwestern Pennsylvania stocking distributor for the full line of toggle clamps manufactured by Detroit Stamping Company, Detroit, Mich.

RUSSIANS GET MORE GAS REFRIGERATORS?

Can this be true?

Gas refrigerator sales are bigger in the Soviet Union than in the United States, Elisha Gray II, board chairman of Whirlpool Corp., told the recent convention of the Pacific Coast Gas Association.

Returned from a visit to the American National Exhibition in Moscow, Gray said that he was "surprised to find one area in the manufacture and distribution of consumer durables where the Russians are way ahead of us. They sell a lot more gas refrigerators in percentage than we do. Twenty percent of their refrigerator production is in gas absorption models. Twenty percent is the goal I have in mind for the United States for 1965."

Gray hastened to explain that he made the comparison with tongue in cheek, because 20% of Russia's total annual refrigerator production amounts to only 60,000 units and that all Russian refrigerators are made without any reference to what the customer wants.

"The Russians," he said, "can have any refrigerator they

continued

The high quality of

NATIONAL LOCK FASTENERS

is more than skin deep

Quality wire is the basic ingredient for quality fasteners. That's why, at National Lock, quality control starts with elements of the raw wire. Here, a unique *spectograph* is used to make a complete qualitative analysis of the metal that goes into National Lock fasteners and cold-headed products. And, too, size, thread dimension, finish and other exacting customer specifications are checked with equal vigilance and thoroughness. National Lock fasteners are quality made inside and out to assure long-term, dependable performance.

STANDARD AND SPECIAL-PURPOSE FASTENERS
FOR AMERICAN INDUSTRY SINCE 1909

NATIONAL LOCK COMPANY
FASTENER DIVISION, ROCKFORD, ILLINOIS

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want so long as it is white and six cubic feet. And so long as they are willing to wait over a year for it after their order has been accepted and qualified." He explained that the waiting list is long and that he visited one plant where they manufacture 400 units a day and where 12 engineers design all the refrigerators for all of Russia. He compared this with Whirlpool alone which employs 150 refrigeration engineers.

KANE TO MANAGE POP RIVET ADVERTISING

Robert H. Kane has been appointed advertising manager of the Pop Rivet Division of United Shoe Machinery Corporation, Shelton, Conn., a newly created position.

Kane was formerly with Heli-Coil Corp., Danbury, Conn., in the same capacity. He has served as advertising and sales promotion manager for the General Electric Supply Co., Bridgeport, and as director of public relations for Connecticut Railway and Lighting.

HUNTER SPRING ADDS FIELD ENGINEER

Field engineer James N. Guthrie will serve the territory, Philadelphia west of Broad Street. A graduate of the University of Pennsylvania, his experience includes field and sales engineering work with E. F. Houghton & Company and the Bunting Brass and Bronze Company.

TWO NEW MANAGERS AT HUGHES AIRCRAFT

Hughes Aircraft has named new managers in its Ground Systems Group in Fullerton, Calif.: John C. Morey, manager of quality assurance, and S. Austin Van Houten, manager of production and material control. Morey was formerly chief of quality engineering at the El Segundo plant and Van Houten, with the company since 1952, with the FBI.

DESIGNERS ELECT LATHAM PRESIDENT

Richard S. Latham, partner in the industrial design firm of Latham, Tyler & Jensen, of Chicago, has been elected president for 1959-1960 of the American Society of Industrial Designers.

Other officers are: Raymond Spilman, vice president, of New York City; Clarence Francis Graser, national secretary, of Poughkeepsie, N. Y.; and Kenneth Van Dyck, reelected treasurer, of Westport, Conn.

Elected to three-year terms as A.S.I.D. directors are William M. Goldsmith of Chicago; Robert H. Hose of New York City; and Milton Immermann of New York City.

SNAP-ON TOOLS ACQUIRES JUDSON ENGIN.

Snap-On Tools Corporation of Kenosha, Wis., has acquired the outstanding common stock of Judson Engineering Corp., Natick, Mass. Purchase of Judson, a manufacturer of automotive wheel balancing and aligning equipment, was achieved by the exchange of Snap-On common stock.

Judson will retain its corporate identity with operations under the direction of R. D. La Penta, chief executive since 1950.

Added to the Judson board of directors were V. M. Cain, president of Snap-On, W. W. Daniel, Snap-On's vice president in charge of production, and R. L. Grover, Snap-On's vice president and secretary.

RICHMONT INC. ADDS NINE DISTRIBUTORS

The Livermont Torque Control System is being distributed by nine new manufacturer's representatives, reports Richmont, Inc., Monrovia, Calif.: C. P. Enston Co., Cleveland; Higginson Equipment Sales Ltd., Burlington, Ontario; Meyer Ekstrom Co., Melrose Park, Ill.; Midwest Supply Co., Tulsa; Monroe & Co., Cincinnati; Nasco Distributing Co., Elizabeth, N.J.; Supplies for Industries, Inc., Tucson, Ariz.; Towle Industrial Corp., Philadelphia; Younger Co., Charlotte, N.C.

● Chances are that with present high wages, your product assembly time and costs are high.

Chances are also that you can make big savings through the use of automated rivet fastenings.

National Automatic Machines are available *tooled specifically to meet your job requirements*. National low-cost automated in-place fastening operation speeds work and reduces employees required by as much as 70 per cent in many cases.

To find out, send sample preferably—or blue print to get our practical recommendations. They can be worth big savings to you.

NATIONAL RIVET & MFG. COMPANY
211 MAIN STREET • WAUPUN, WISCONSIN

NATIONAL RIVETS
TUBULAR, SPLIT, SOLID ALL METALS

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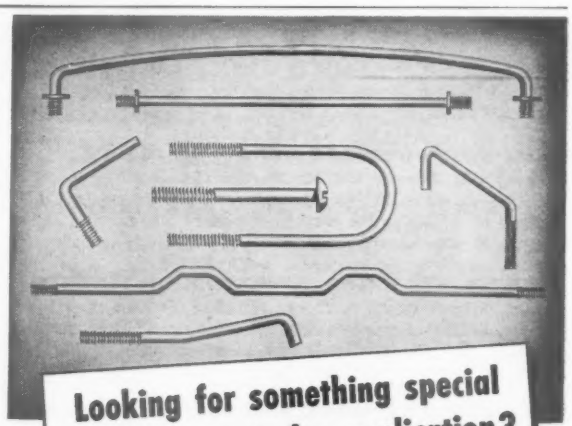

Looking for something special ...for a particular application?

...rely on Ohio Rod Products for—

SERVICE—QUALITY—UNIFORMITY

OHIO ROD makes Special Headed and/or Threaded Fasteners in short and long length – in short or long runs. Headed, Threaded, Collared, Bent, or Offset.

Send drawings or blueprints for quotes and literature.

OHIO ROD PRODUCTS CO., INC.

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KESTER SOLDER OPENS CALIFORNIA PLANT

Kester Solder Co., Chicago, Ill., is handling western states orders from a new manufacturing facility in Anaheim, Calif.

ALL-STATE PROMOTES SOUTH AMERICA REP.

Jack Muller, special sales representative in Latin America, has been appointed sales director for South American countries, announces T. D. Nast, president of All-State Welding Alloys Company, Inc.

Muller has worked in Argentina for some 14 years, since 1956 has been on the sales staff of American concerns interested in developing Latin American business. He will be headquartered in Buenos Aires, Argentina.

VALUE ANALYSIS ADDS NEW CONSULTANT

Wayne F. Ruggles of Wheaton, Ill. has become associated with Value Analysis, Inc., Schenectady, N.Y., a consulting firm offering services designed to eliminate costs in the business cycle from product design to customer purchase. He will provide consultation to the midwest area. Ruggles was with the Hotpoint Division of General Electric Co. since 1950.

KINZEL HONORED BY RESEARCH INSTITUTE

Dr. Augustus B. Kinzel, vice-president—research of Union Carbide Corporation was named recipient of the Industrial Research Institute Medal for 1960. The medal has been awarded annually since 1945 to honor "outstanding accomplishment in leadership in or management of industrial research which contributes broadly to the development of industry or the public welfare."

A research metallurgist, Dr. Kinzel specialized in stainless steels. His work on deoxidizing and alloying elements pioneered the structural low-alloy steels and the new ferro-alloys and provided major advances in the welding and cutting of steel. More than 40 patents have been issued in his name.

WHITTAKER CONTROLS NAMES ENGIN. MGR.

John R. Morton has been appointed production engineering manager of the Whittaker Controls Division of Telecomputing, Los Angeles, California.

Morton will divide his time between the Hollywood and Lynwood plants, and will be responsible for production planning, tooling and equipment, cost estimating and pricing, cost reduction and prototype manufacturing. He was formerly with Bourns, Inc., Riverside, as production manager.

STERLING BOLT ACQUIRES FOUR DIVISIONS

Two Texas fastener manufacturers have consolidated with the Sterling Bolt Co. of Chicago. Effective Dec. 1, the Texokana Bolt & Nut Co., Dallas, and the Gulf Coast Bolt and Nut Co., Houston, became manufacturing and distribution centers for Sterling.

President Herbert Gordon pointed out that the November acquisition of East Coast Nut and Bolt Co., New York City, and Penn Bolt and Nut Co., Pittsburgh, gives Sterling a national organization. No personnel changes were made.

NATIONAL ELECTRIC EXPANDS SALES FORCE

National Electric Welding Machines Co., Bay City, Mich., has established three new sales offices. A new West Coast office, covering the northern half of California and all of Oregon and Washington, is manned by William M. Corns of Ross, Calif. William E. Dowling, vice-president of R. E. Duboc Associates of Denver, services the five-state territory of New Mexico, Utah, Wyoming, Idaho and Colorado. A new southern office, covering parts of Mississippi and Georgia and all of Tennessee and Alabama, is serviced by H. J. (Jack) Yarbrough of Welding Alloys and Supply Co., Inc., of Birmingham, Ala.

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To assist the Chicago office in the eastern half of Minnesota, National Electric has named Ray Schwabe of Welding Supply and Specialty Co., of St. Paul, Minn.

GARDNER-DENVER BROADENS FINANCE DEPT.

Broadening of the financial departments of Gardner-Denver Company and election of a president of a subsidiary has been voted by the board of directors.

A. G. Lindquist, who has been vice-president and treasurer since 1954, was elected financial vice-president and secretary. Robert H. Meystre was elected treasurer of Gardner-Denver, reporting to the financial vice-president. Also reporting to the financial vice-president will be William Miller, controller. Kenneth J. McDaniel, who has been secretary, was named president of one of the company's South American subsidiaries, Gardner-Denver do Brazil, S. A.

SALES CHANGES AT EUTECTIC WELDING

John P. Broderick has been named supervisor of technical services at Eutectic Welding Alloys Corp., Flushing, N. J. Three technical representatives were promoted to sales supervisors: Richard O. Drossman, Pennsylvania, Western Maryland, West Virginia; Gordon L. Phillips, New Jersey, Delaware, Philadelphia, Baltimore and Eastern Maryland; Howard M. Gans, New York State.

HELI-COIL APPOINTS ADVERTISING MGR.

Donald Lee has been appointed advertising manager and placed in charge of all sales promotion and public relations activities of the Heli-Coil Corporation, Danbury, Conn. Lee has been associated during the past 12 years with the United Aircraft Company, East Hartford, Conn. as assistant to the director of advertising. He is a former Marine Corps pilot.

LEAR'S INSTRUMENT ASSEMBLY plant dedication drew 12,000 guests to inspect the $2 million, 172,000 sq. ft. facility in Grand Rapids, Mich. Highlight of the tour was the super-clean gyro assembly area which is temperature and humidity-controlled.

ASME HONORS ENGLISH MATHEMATICIAN

The Timoshenko Medal, given for distinguished contributions to the basic engineering science of applied mechanics, was awarded for 1959 to Sir Richard V. Southwell, former rector of the Imperial College, London, England.

Sir Richard's medal was presented at the Annual Meeting of The American Society of Mechanical Engineers, which voted him the award.

He was cited "for teaching and research in the application of mathematical and numerical techniques to the solution of practical problems in engineering science." Famed as an authority on elasticity, strength of materials, hydrodynamics and other applied mechanics specialties, Sir Richard is the author of several books and over one hundred technical papers.

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NHMA EXPECTS 12,000 AT CHICAGO SHOW

Some 12,000 buyers representing every state will attend the 32nd National Housewares Manufacturers Association shows Jan. 11-15 in Chicago. Exhibitors at the Navy Pier site will total 731.

NYLOK-DETROIT NAMES PLANT MANAGER

Appointment of E. N. Wash as plant manager of Nylok-Detroit Corp. is announced by R. B. Wallace, President. Wash will have responsibility for all production operations and personnel matters at the company's expanded manufacturing facilities in Troy, Michigan.

KAYNAR ADDS EASTERN SLS. MGR.

William Curtis has been named Eastern regional sales manager of Kaynar Mfg. Co., Inc., announced K. D. Davis, sales manager, Kaylock Division, Los Angeles.

Curtis comes to Kaynar after eight years of sales engineering experience in aircraft and industrial fasteners. He is a graduate of Lafayette College, Easton, Pa., with an M.E. degree. Headquarters will be in Madison, N.J.

ARMOUR ENGINEERS PROBE BRAZING

The third article of a series dealing with the reactions of the molten metal, in brazing operations, when it contacts the metal to be joined, is dealt with in a paper by N. Bredzs and H. Schwartzbart, Armour Research Foundation of Illinois Institute of Technology, presented at the national fall meeting of the American Welding Society in Detroit.

The paper deals with the problem of compounds formed between the molten brazing metal and the solid metal it is

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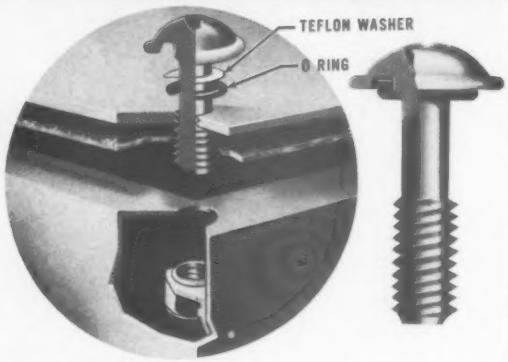

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to join. Some metals dissolve others, some alloy with each other, while certain metals have no effect upon each other. The study should do much to determine which brazing alloy to use since it was found that the strength of some brazing alloys were reduced according to the composition of the alloy.

REDWINE NAMED ASSISTANT AT ETC INC.

Appointment of John B. Redwine to be assistant to the president of ETC Inc., Cleveland, has been announced by Edward M. Muldoon, president.

A graduate engineer, Redwine served with naval ordnance and as a commissioned electronics expert with the U.S. Air Force. He brings to ETC considerable experience as a sales engineer working with industrial accounts.

WALDES NAMES MINNESOTA DISTRIBUTORS

Waldes Kohinoor, Inc., Long Island City, N.Y. has named two new Truarc distributors: Minnesota Bearing Co., Minneapolis, for Minnesota and the Dakotas, and Velie Sales, Inc., Minneapolis, as engineering sales representative for the same area.

RB&W NAMES NORTHERN OHIO SALES REP.

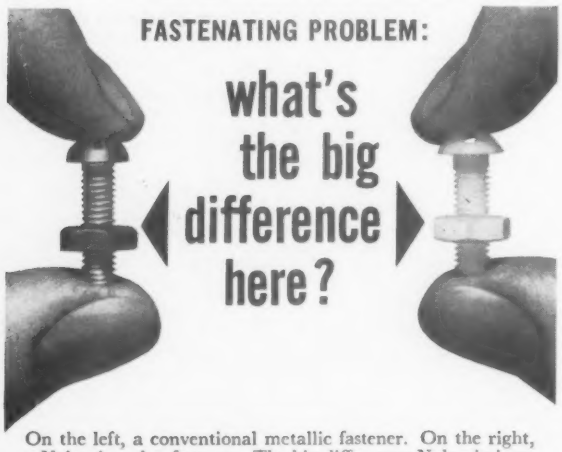
Paul Minarik Company has been appointed sales representative in northern Ohio for Russell, Burdsall & Ward Bolt and Nut Company. Headquartered in Rocky River, Ohio, the firm will cover the area bordering Lake Erie between Toledo and the Pennsylvania border.

TWO ENGINEERS JOIN POLY INDUSTRIES

Two project engineers have joined the design staff of Poly Industries, Inc., Pacoima, Calif. Eli Orshanksy will work on pumps and Alexander V. Fioretta on valves and control equipment.

FASTENATING PROBLEM:

what's the big difference here?



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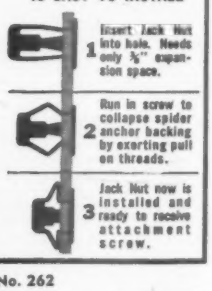
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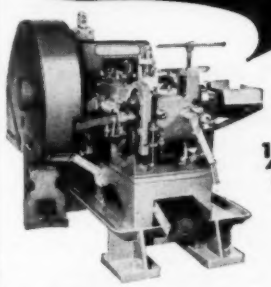

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NO BREAKTHROUGH IN 1960 – BUT THE NEWS IS GOOD

The ringing in of a new year is the bell for another round with the soothsayers and crystal-ball gazers, tolling their prognostications and statements filled with pomp like a Christmas goose. The turning of a year is indeed the time of wisdom. Percentages, figures, trends, consumptions and indexes—all of us will be thwacked about the head and have the future pounded into us, right or wrong, until we too, even the dumkoph editor, feels the warmth of wisdom.

And really, there is no harm in this indoor sport. Soothsaying is part of human make-up. My smallest boy announced in 1958 that he felt 1959 would be a tough school year; the other day he prophesized that 1960 would be better than 1959. The need for speculation and tea leaf reading is universal to all. It spares neither young nor old, the wise man or the editor.

We do not want to discuss profits and losses in the assembly and fastener industry, nor what the new year holds business-wise. We would rather project a few thoughts based on this past year's trends, on the attitude of general industry toward fastening and assembling operations. While spotty, the news is good!

There is taking place a general awakening, by industry, of the importance of fasteners and methods of putting things together. Many of the companies with whom we've talked in the past few months are beginning to wonder if possibly nuts and bolts are not the chicken dirt that they had, for so many years, assumed them to be. Engineers, too, are looking into the subject with a more intelligent awareness and a more questioning mind—a change from years ago when the average engineer felt himself to be above this sort of thing.

Let us not hastily assume, with loud handclappings, that this change is universal. It definitely is not, but the trend is positively here.

A fastener manufacturer conducted a conference in Detroit, and gathered in such a large audience, that he literally had to close the doors at midnight and ask them to please go home. At a meeting held by another manufacturer, attendance was primarily composed of top engineering chiefs, with their staff members—in contrast to previous meetings which were attended only by staff members and nary a chief. The manufacturers of fastening and assembling equipment are greatly encouraged to think that their many years' missionary work, in attracting top thinking to the importance of the fastener, is bearing fruit.

Users, too, are taking more than a second look at the problem of fastening and assembling, tied up as this subject is, with reliability, cost, service and production. The trend toward this awareness is definite. There is no doubt about it, even though it is not general. There are still many companies, and among them one of the country's largest, who still dismiss the subject as too lowly for their superior consideration. They are the ones who buy on price and get it as cheap as possible. Then, to make sure that they get a passable product, hire 25 inspectors in one plant to do nothing but give incoming screws a 100% check. So there remains much work to be done. To those who are impatient, we can only say—eat three square meals a day, get eight hours of sleep, and don't worry.

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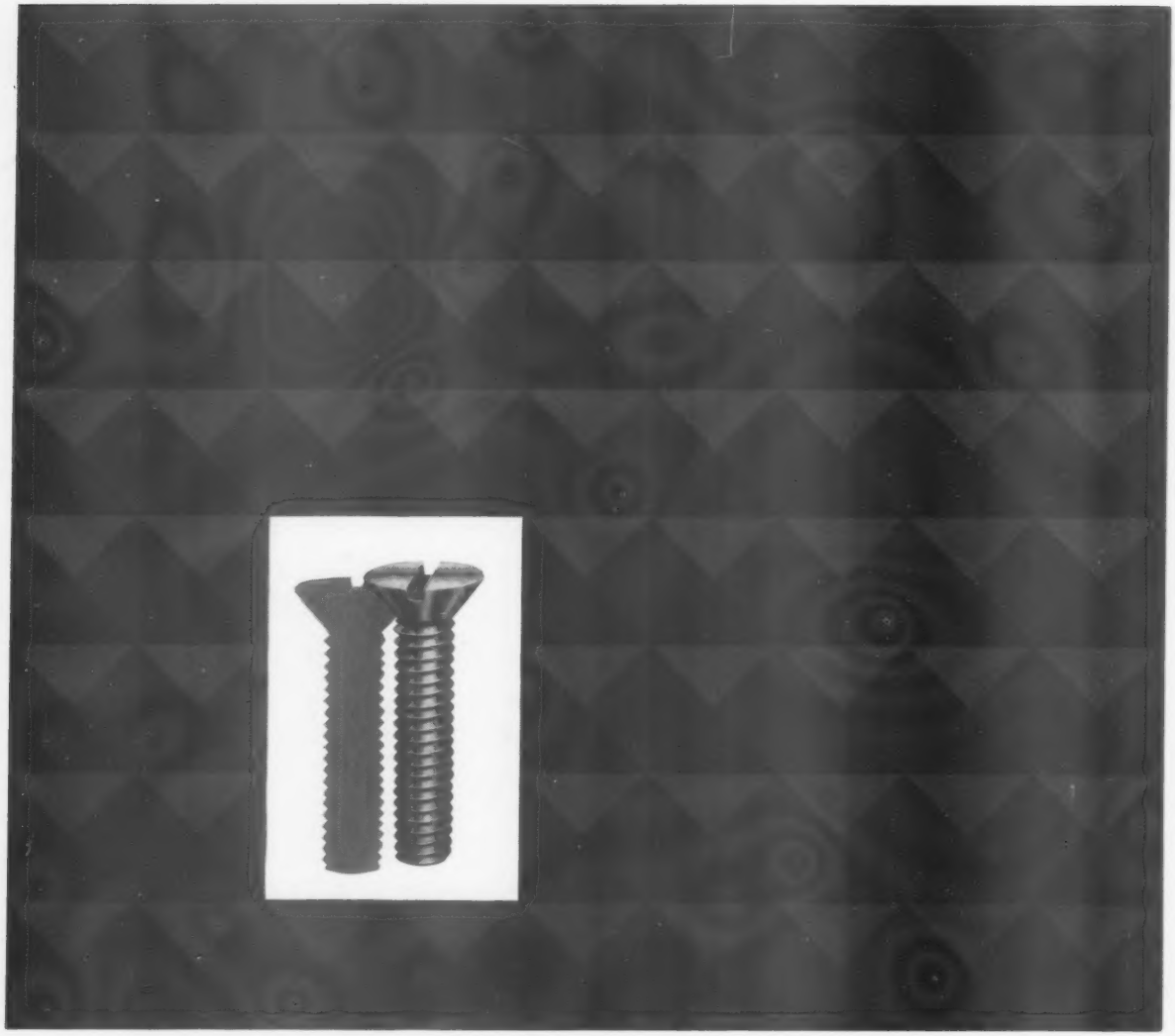

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